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ABSTRACT

Girls Into Science and Technology (GIST), an action research project that ran from 1979 to 1983, aimed to study the reasons for girls' under-achievement in science and technology and to take action to remedy the situation. A cohort of 1,700 young people in ten co-educational comprehensive schools in the Greater Manchester area were followed from the ages of 11 to 17. Interventions were implemented during their first 3 years in eight of the schools (the action schools). This paper presents a detailed statistical analysis of the quantitative data from the GIST project, which explores the differences between pupils from action and control schools. It confirms preliminary results which showed that GIST was most effective in reducing sex stereotypes. The project also had some impact on attitudes to science, but subject choices did not vary substantially between action and control schools. When subgroups were examined, it emerged that GIST was most effective in changing the subject choices and attitudes of middle class and/or academically able girls. The project seemed to have had much less effect on boys. Some of the effects of being in an action school persisted to age 17. Numerous statistical tables and graphs are included. A 62-item annotated bibliography of publications from the GIST Project concludes the document. (JB)

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Getting the GIST: A Quantitative Study of the Effects of the Girls Into Science and Technology Project

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MANCHESTER SOCIOLOGY OCCASIONAL PAPERS

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Getting the GIST:
A Quantitative Study of the Effects of the Girls into Science and Technology Project

Alison Kelly

Department of Sociology
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Abstract

Girls Into Science and Technology (GIST) was an action research project which aimed both to study the reasons for girls' under-achievement in science and technology, and to take action to remedy the situation. A cohort of 1700 young people in ten co-educational comprehensive schools in the Greater Manchester area were followed from the ages of eleven to seventeen. Interventions were implemented during their first three years in eight of the schools (the action schools). This paper presents a detailed statistical analysis of the quantitative data from the GIST project, which explores the differences between pupils from action and control schools. It confirms preliminary results which showed that GIST was most effective in reducing sex stereotypes. The project also had some impact on attitudes to science, but subject choices did not vary substantially between action and control schools. When sub groups were examined it emerged that GIST was most effective in changing the subject choices and attitudes of middle class and/or academically able girls. The project seemed to have had much less effect on boys. Some of the effects of being in an action school persisted to age seventeen. There were a large number of significant differences between schools even after allowing for differences in intake.

Acknowledgment

The GIST project was funded by the Equal Opportunities Commission, the Social Science Research Foundation, the Schools Council, the Department of Industry Education Unit and Shell UK Ltd. This Report was written while I was on study leave, supported by a Nuffield Fellowship. I am grateful to all these sponsors, and to my colleagues on the project, Judith Whyte, Barbara Smail and John Catton. However they do not necessarily share the opinions expressed in this Report.

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Getting the GIST: A Quantitative Study of the Effects of the Girls Into Science and Technology Project

1. Introduction

1.1 The Project

Girls Into Science and Technology (GIST) was an action research project which ran from 1979 to 1983. It simultaneously explored the reasons for girls' avoidance of physical science and technical craft subjects when these became optional at school, and devised and implemented strategies to remedy the situation. The conduct of the project has been described in several publications (e.g. Kelly, Whyte and Small 1984; Whyte, 1986), and I will only sketch a rough outline here. The main purpose of this report is to explore in detail the measurable effects of the project on children's option and career choices and their attitudes to science and to sex roles.

All the children in one year group at ten co-educational comprehensive schools in three LEA's in Greater Manchester were involved in the project. They were studied from the time they entered secondary school, aged 11, until they made their option choices three years later. In eight of these schools (the action schools) the project team collaborated with teachers on a variety of interventions aimed at improving the attitudes and enrolments of this cohort of girls in science and technology. Two other schools took part in the project as controls, where attitude tests were completed, but no interventions were attempted. Although not a random sample, the schools served a wide variety of socio-economic catchment areas, and were reasonably representative of urban comprehensive schools in England in terms of their facilities and staff.

The interventions implemented in the action schools included a programme of visits by women working in technical jobs who talked about their work and provided role models for the girls; the preparation of posters and worksheets about women's contribution to science; curriculum development to produce teaching materials more orientated towards girls' interests and a humanistic view of science; observation of teachers in the classroom with feedback on how to increase girls' participation; discussion with staff and pupils about the limiting effects of sex role stereotypes; and careers advice linked to option choices in schools. Many of these interventions were

implemented by classroom teachers, and several schools developed their own initiatives such as single sex grouping for physics lessons or a girls-only work experience scheme in engineering.

Research results showed that girls and boys had almost equal science knowledge when they entered secondary school. However their attitudes were already sharply divergent, with girls being interested in biological topics and boys in physical science. At the end of third year boys got slightly better marks than girls in physical science; but boys' estimation of their own achievement was **much** better than girls'. This was particularly true in physics, which both girls and boys considered the most difficult science. Boys were much more likely than girls to see physics as useful for their careers and to choose it for that reason.

Both at eleven and at fourteen boys were more sex stereotyped than girls. They had more definite ideas about what girls should do and what boys should do. In particular boys were more likely than girls to agree with statements such as 'a woman could never be a great scientist' and 'girls don't need to know about electricity or light'. These attitudes were reflected in their behaviour in the laboratory and workshops where boys tended to monopolise the equipment and taunt girls who made mistakes. At age fourteen 22% of boys said they didn't want their wives to be employed, but only 4% of girls wanted to be permanent housewives.

Preliminary results suggested that GIST had more success in altering children's attitudes than their subject choices. Pupils in action schools became markedly less sex stereotyped than pupils in control schools. They also had slightly better attitudes towards science and scientists. A team of independent evaluators interviewed teachers who had been involved in the project and concluded that they were generally reluctant to admit that GIST had influenced them or to concede that their behaviour was in any way responsible for girls' avoidance of physical science. However there was some evidence of change in teachers' behaviour and those who received institutional support for innovation were in the best position to respond actively. Perhaps the greatest impact of the project was a ripple effect whereby interest in GIST helped to establish girls' under-achievement in science as a serious educational issue and to suggest actions that concerned teachers could take in their own schools.

These preliminary conclusions on the effect of the interventions are detailed in the Final Report on the project (Kelly *et al*, 1984), the evaluators report (Payne, Hustler and Cuff, 1984) and the book length account (Whyte, 1986). At the time these were written the quantitative information from the different questionnaires had not been merged into one data set; moreover the external examination results and later career choices of the pupils were not available. Since then a substantial amount of additional information has been collected, and the existing data has been explored in more depth. The purpose of the present report is to examine quantitatively the effects of the GIST interventions on the attitudes and expectations of the pupils in action schools, by comparing them with pupils in control schools. An annotated list of all the publications resulting from the GIST project is included as Appendix A.

The data for this quantitative study comes from two attitude surveys completed during the course of the project, plus three follow-up studies (see Table 1.1). During their first term at secondary school, September to December 1980, all 2065 children at the ten schools completed a battery of tests covering sex stereotypes, attitudes to science, cognitive skills and background information. Between March and May 1983 the 1773 children who remained in the same schools, and who were now in their third year, completed a second battery of tests. Some of these were identical to those in the first round of testing; others concentrated on the pupils' experience of science and technology education, and the process of option and career choices. Six months later, in October 1983, details of the children's final option choices for fourth and fifth year were collected from the schools. In the autumn of 1985 we returned to the schools once again, to collect information on the pupils' performance in their O level and CSE examinations. At this stage data was also obtained on the option choices of the two year groups following the GIST cohort. Information on the option choices of the three years preceding the GIST cohort had been collected during the intervention stage of the project. Finally in October 1986, a postal questionnaire was sent to the home addresses of the young people, then aged seventeen. This requested information on their study or employment since reaching the school leaving age, and on their plans for the future. Replies were received from 1025 young people, comprising 66% of those for whom addresses were available and 58% of those we had worked with from first to third year.

Table 1.1 The timetable for data collection on the GIST project

Date	Pupil age	School events	GIST intervention	Data collection
Sept 1980	11	Enter 1st year	x	Initial attitude tests
			x	
			x	
Sept 1981	12	Enter 2nd year	x	
			x	
			x	
Sept 1982	13	Enter 3rd year	x	
			x	Second attitude tests
		Option choices made		
Sept 1983	14	Enter 4th year		Option choices
Sept 1984	15	Enter 5th year School leaving age External examinations		
Sept 1985	16	Enter lower 6th		Examination results
Sept 1986	17	Enter upper 6th		Postal questionnaire

The Schools

The schools involved in the GIST project were not a random sample. For practical reasons, to do with ease of travelling between and liaising with the schools, the project was limited to ten institutions. This raises certain problems for the statistical analysis of the data. In this section I want to explore some of the differences between the intakes of the schools, and introduce some of the background factors which will be used as controls in the more detailed analyses to follow.

Schools were approached either through contacts involved in teacher training or after consultation with science advisors. Random sampling was rejected in favour of this more personalized approach in the hope that it would minimize the refusal rate; in the event only two of the schools we approached indicated, both at a very early stage, that they did not wish to become involved. This is not to say that all the schools participating in the project were favourably disposed towards equal opportunities work, or had particularly strong science departments. Some were chosen on these grounds, but others were picked because the science advisors felt that they needed

some external stimulus, or because they were known to be reluctant to introduce mixed crafts. For our qualitative analysis we also wanted to ensure a range of other school characteristics (such as male and female headteachers, the presence and absence of a strong group of female science teachers, inner city and suburban schools). With so many variables and so few schools, random sampling became impossible. The schools can best be described as a judgement sample. Their characteristics are described qualitatively in Judith Whyte's account of the GIST project (1986).

One of the problems with using data which is not derived from a random sample is that significance tests, which measure sampling variation, are meaningless. Nevertheless significance tests, appropriate to simple random sampling, are included throughout this report. Although they cannot be interpreted as testing any specific hypothesis, they provide a general indication of which differences might be due to the normal variation between individuals. Effect sizes, expressed as correlations or eta coefficients (both of which indicate, when squared, the percentage of the variance explained) are also included throughout the report. These are of more fundamental interest than significance tests because they measure the magnitude of a relationship and are not dependent on sample size.

Some of the characteristics of the ten GIST schools are illustrated in Table 1.2 and Figures 1.1, 1.2 and 1.3. Throughout this report the schools are identified by pseudonyms to protect their anonymity.

Table 1.2 Number of respondents from each school at each stage of the GIST project

	Abbreviation	Number of respondents 1st yr	3rd yr	17+	3rd yr as % of 1st	17+ as % of 3rd yr
Action schools						
Ashgrove	A	200	151	71	75.5	47.0
Edgehill	E	263	240	177	91.3	73.7
Green Park	GP	206	163	57	79.1	35.0
Hamlet	H	193	153	77	79.3	50.3
Meadow Vale	MV	265	248	141	93.6	56.9
Moss Green	MG	142	114	51	80.3	44.7
Suttonhill	S	225	205	115	91.1	56.1
Tall Trees	TT	155	148	99	95.5	66.9
Control schools						
Burnbank	B	117	89	49	76.1	55.1
New Hall	NH	299	262	188	87.6	71.8
Total		2065	1773	1025	85.9	57.8

Figure 1.1 shows the average score of the intake to each school on four background measures. The first of these is an academic ability measure, IQALL. During their last year at primary school most of the children had completed a standardized achievement and/or intelligence test. Their scores on this test were passed on to the secondary schools at transfer, and thus to GIST. Thirteen different tests were used in all, some children having taken two or three of them. In order not to increase the burden of testing in the schools we decided to make use of these scores rather than administer another ability measure. Accordingly a very crude academic ability measure, IQALL, was computed by simply treating all the tests as equivalent, and averaging the scores if the children had completed more than one test. Where comparisons were possible the tests were indeed highly correlated. IQALL is particularly problematic at Green Park and Tall Trees, where it was based upon reading ages which were only recorded accurately for below-average children. IQALL was available for 1686 (95%) of the GIST cohort.

The second background variable, SES, is a measure of socio-economic status, based upon parental occupations. Children were asked for details of their parents' jobs in a Background Questionnaire completed during their first term at secondary school. If parents were unemployed the children were asked about their last job. The occupations were grouped into social classes according to the Registrar General's classification, and then recoded as follows:

Mothers	
Professional	5
Semi-professional	4
White collar or skilled manual	3
Housewife, semi-skilled or unskilled manual	2
Unidentifiable, unknown, no reply, no mother	1
Fathers	
Professional or semi-professional	5
White collar	4
Skilled manual	3
Semi-skilled or unskilled manual	2
Unidentifiable, unknown, no reply, no father	1

The diffarent coding for mothers and fathers was intended to reflect the different structure of the male and female labour markets, with many women employed in semi-professional jobs such as nurse or teacher, and little status distinction between skilled manual work and the 'paper production line' of office work. The codes for mother's and father's occupations were then summed to produce the variable SES for each child. Two schools, Hamlet

and Suttonhill, were unwilling to administer the Background Questionnaire, but supplied details of parents' occupations from school records when the children were in third year. It is noticeable that a lower level of employment, for both mothers and fathers, was recorded in these two schools; moreover no information was available on the previous occupations of unemployed parents. SES was available for 1545 (87%) of the 1773 children in the GIST study.

The third variable, NSIB, is a simple count of the number of siblings each child in the study had. This information also came from the Background Questionnaire, which was not administered at Hamlet and Suttonhill. So this variable was only recorded for 1238 (70%) of the pupils.

The final background variable was intended to measure the extent to which academic activities are engaged in within the home (or, in the words of Bourdieu (1977), the cultural capital the child possesses). This Cultural Capital Scale (CULTCAP) was derived from eighteen questions on the Background Questionnaire, as follows:

1. About how many books are there in your house?
   less than 50/50 - 200/over 200
2. How much time do you spend reading for pleasure each week?
   less than 1 hour/1 - 3 hours/more than 3 hours
3. Do you ever borrow books from the library?
   never/less than once a month/more than once a month
4. Do you ever go to museums and art galleries?
   never/less than once a year/more than once a year
5. Does anyone in your house ever look things up in a dictionary or encyclopedia?
   no/yes, sometimes/yes, often
6. Does anybody ever ask what you've been learning at school?
   no/yes,sometimes/yes,often
7. How much time do you spend watching television each evening?
   less than 2 hours/2 - 4 hours/more than 4 hours (reversed)
8. How much time do you spend 'playing-out' each evening?
   less than 2 hours/2 - 3 hours/more than 3 hours (reversed)

What do you usually do in the evenings?

9. Homework - not mentioned/mentioned
10. Intellectual hobbies (e.g. chess) - not mentioned/mentioned

What do you usually do on Saturdays?

11. Homework - not mentioned/mentioned
12. Intellectual hobbies (e.g. chess) - not mentioned/mentioned

What do you usually do on Sundays?

13. Homework - not mentioned/mentioned
14. Intellectual hobbies (e.g. chess) - not mentioned/mentioned

What do the grown-ups in your house do in the evenings and at weekends?

15. Mother, non-intellectual, at home (e.g. knitting) - not mentioned/mentioned

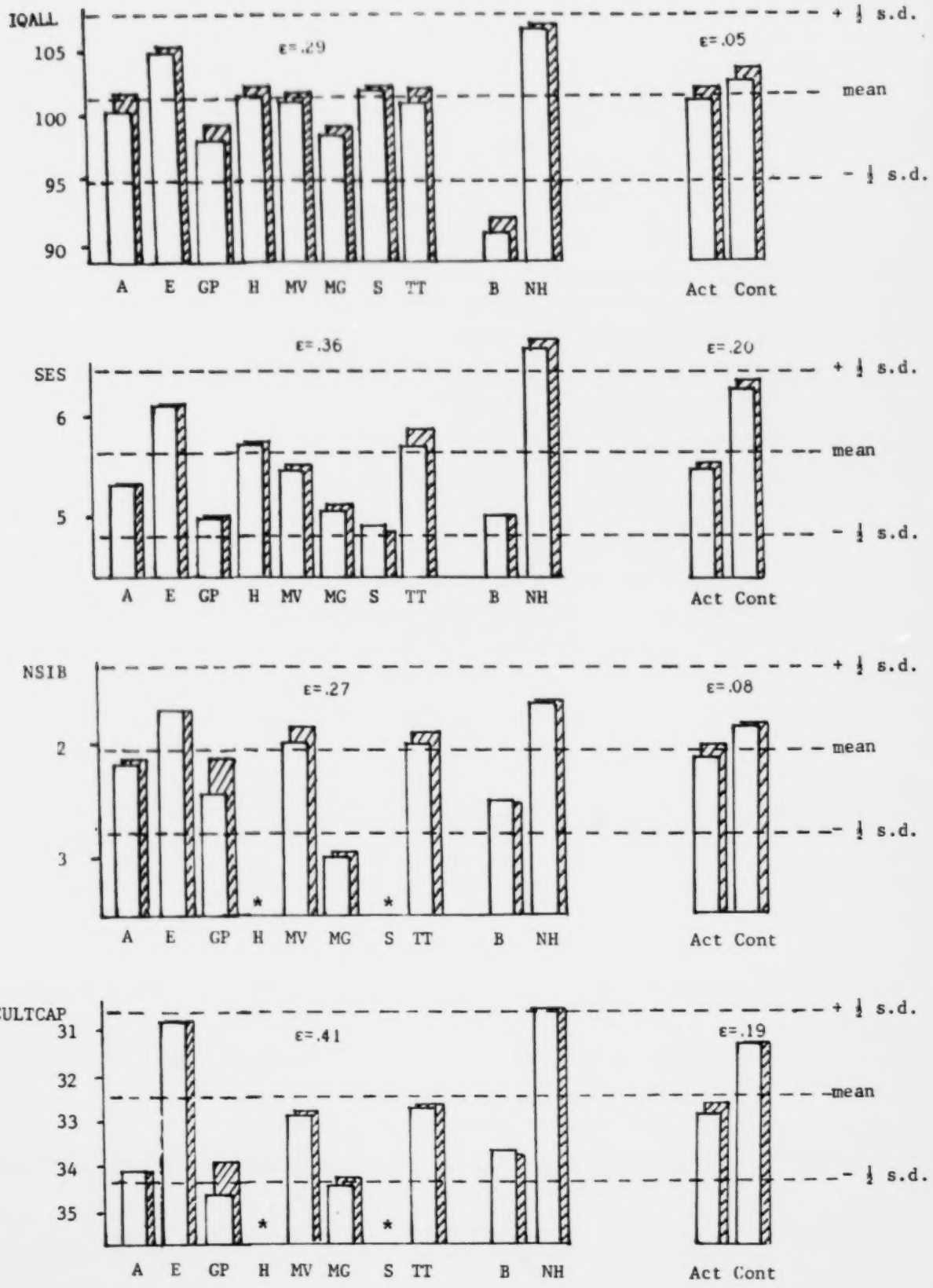
16. Mother, intellectual, at home (e.g. chess) - not mentioned/ mentioned
17. Father, non-intellectual, at home (e.g. knitting) - not mentioned/mentioned
18. Father, intellectual, at home (e.g. chess) - not mentioned/ mentioned

The reliability of the Cultural Capital Scale, as measured by Cronbach's alpha, was .66. It was not improved by dropping any items, nor by including any others (such as the frequency of parental attendance at school meetings). Although its reliability is not high, the Cultural Capital Scale proved to be an important discriminator between individual pupils' school performance (see below). Scores on CULTCAP were available for 1126 (64%) of the GIST cohort.

Figure 1.1 shows the mean score of pupils in each school on the four background measures. The variables have been scaled to the same mean and standard deviation, so that the diagrams are directly comparable. It is clear that the intakes to the schools vary substantially, although there is more variation (as measured by the eta values) on some factors than on others. Schools vary more in the average cultural capital and socio-economic status of their pupils than in their average academic ability or number of siblings. There is a distinct tendency for schools that are advantaged on one variable also to be advantaged on the others. Pupils at the control school New Hall had the highest average academic ability on entry, the highest socio-economic status, the fewest siblings and the greatest amount of cultural capital. They were followed on all these measures by Edgehill. Hamlet, Meadow Vale and Tall Trees formed a group of schools with medium scores on all the intake measures, while Green Park, Moss Green and Burnbank tended to have low mean scores.

Figure 1.1 also shows that on all the measures the mean of the two control schools was higher than the mean of the eight action schools. Within the control group the scores of the large suburban school, New Hall, with 262 pupils, outweighed those of the much smaller inner city school, Burnbank, with only 89 pupils. This discrepancy between the intakes of action and control schools makes it difficult to evaluate the effects of the interventions.

Figure 1.1. Mean scores of pupils in each school on the background variables.



To overcome this problem a composite measure of home background was developed, to be used as a control variable in the analyses that follow. The composite was formed by regressing the four intake measures onto an outcome measure, EXAMTOT, which was derived from the pupils' results on O level and CSE examinations. Examination results were collected from the schools in October 1985 and the grades for each subject were recoded as follows:

8: O level grade A
7: O level grade B
6: O level grade C or CSE grade 1
5: O level grade D or CSE grade 2
4: O level grade E or CSE grade 3
3: O level grade U or CSE grade 4
2: CSE grade 5
1: CSE grade U

The scores were then summed to form the Examination Score (EXAMTOT), a measure of each child's school achievement at age sixteen. This was available for 1492 (84%) of the children who were in the GIST schools for their first three years of secondary schooling. The remaining children were a mixture of those who had transferred to other schools between third and fifth year and 'Easter leavers', who had not attempted any external examinations.

Figure 1.1 shows that there was a slight but consistent tendency for children for whom an Examination Score was available to score above average on the intake measures - as might be expected if 'Easter leavers' tend to be from disadvantaged backgrounds. The distribution of the Examination Score itself between schools is given in Figure 1.2. It shows a similar, although by no means identical, between-school pattern to the background measures.

The coefficients for the prediction of the Examination Score from the four background measures are shown in Table 1.3, with the variables listed in the order in which they entered the equation. All four measures made a highly significant contribution (beyond the 0.1% level) to explaining the variance in Examination Score and together they accounted for 50% of the variation in individual performance. However only 945 (53%) of the pupils had complete data on all four independent variables used in this regression (and 108 of these did not have data on the dependent variable). Two schools were missing altogether because they did not administer the Background Questionnaire. This degree of data-loss was not acceptable in developing a background score intended to control for between-school differences. Pupils with missing data on a particular variable were therefore assigned the mean

Table 1.3. Coefficients for the prediction of Examination Score at sixteen from background factors at eleven

	Pupils with complete data			All Pupils		
	Regression	Correlation	Multiple	Regression	Correlation	Multiple
	β	r	R^2	β	r	R^2
IQALL	.38	.58	.33	.41	.57	.33
CULTCAP	.30	.54	.45	.25	.47	.41
SES	.17	.42	.48	.18	.40	.44
NSIB	-.15	-.32	.50	-.12	-.27	.46

score on that variable of other pupils in their school. Pupils at Hamlet and Suttonhill were all given the overall mean score on NSIB and CULTCAP.

When the regression was repeated including these surrogate values, the explained variance fell to 46% of the total (R^2 in Table 1.3). A composite Background Variable, BACKGR, was derived from the four intake measures, using the regression weights. The mean value in each school is shown in the first part of Figure 1.2. The eta value of .45 indicates that there were substantial variations between schools in the background of their pupils.

The second part of Figure 1.2 shows the differences between schools in Examination Scores. The eta values show that these variations were larger than the variations in the Background Variable. In particular there was a substantial difference between the action and control schools in the average performance of their pupils in external examinations.

In order to examine whether the schools varied in their outcomes once the best possible efforts had been made to control for the effects of different intakes, an analysis of variance was performed, with Examination Score as the dependent variable, school as the independent variable and the Background Variable as a covariate. The final part of Figure 1.2 shows the residual over or under-achievement in each school, compared to the performance which would be predicted on the basis of the Background Variable. The eta values indicate that these residuals were substantial and significant beyond the 0.1% level. In the context of the debate about school effects (Reynolds, 1985; Rutter *et al* 1979) this is an interesting finding in itself. It is not the main purpose of this report to discuss differences between schools *per se*, although some analysis is presented in Chapter 7.

Figure 1.2. Mean scores of pupils in each school on BACKGR, EXAMTOT and residual EXAMTOT after allowing for the effect of BACKGR.

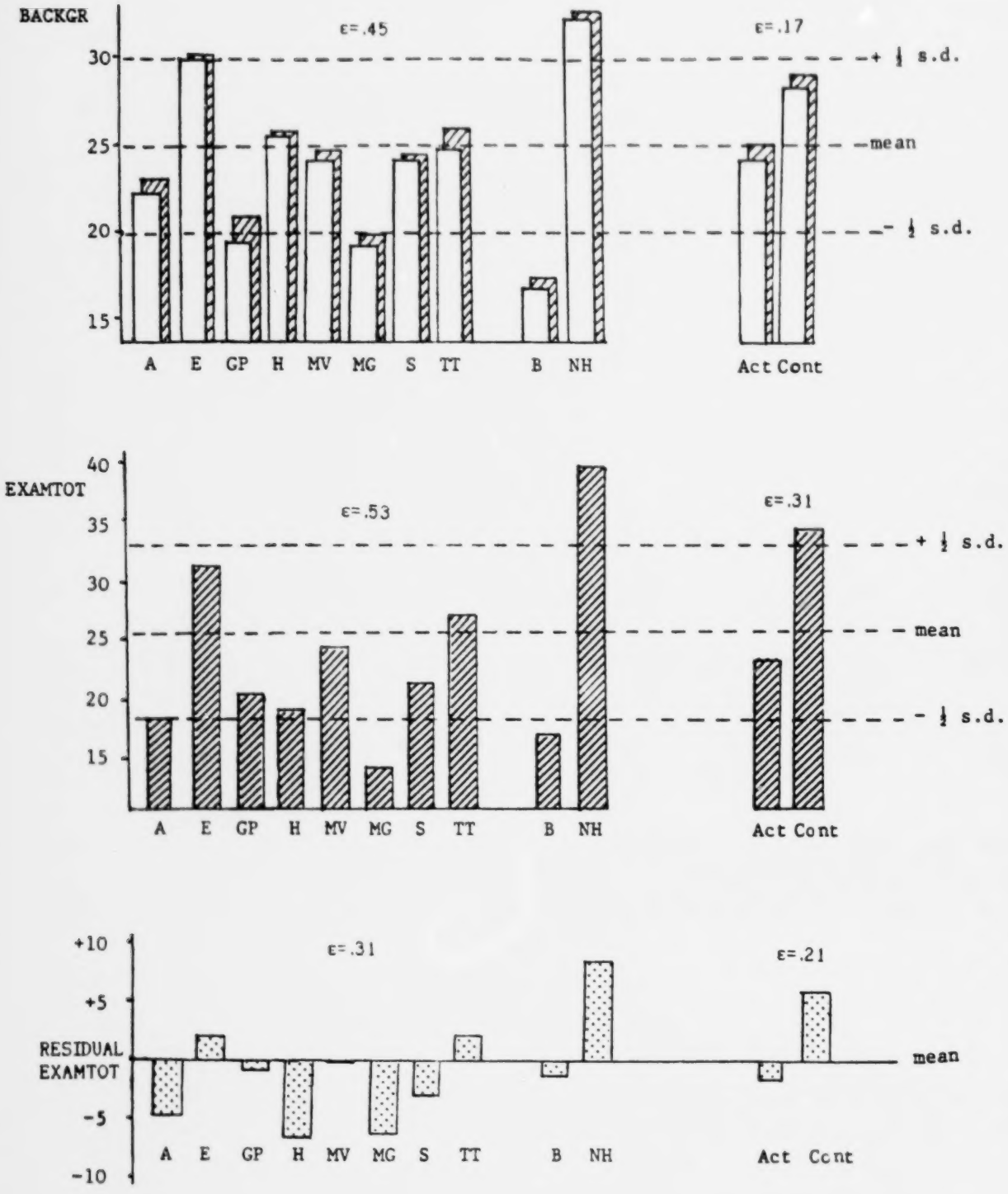
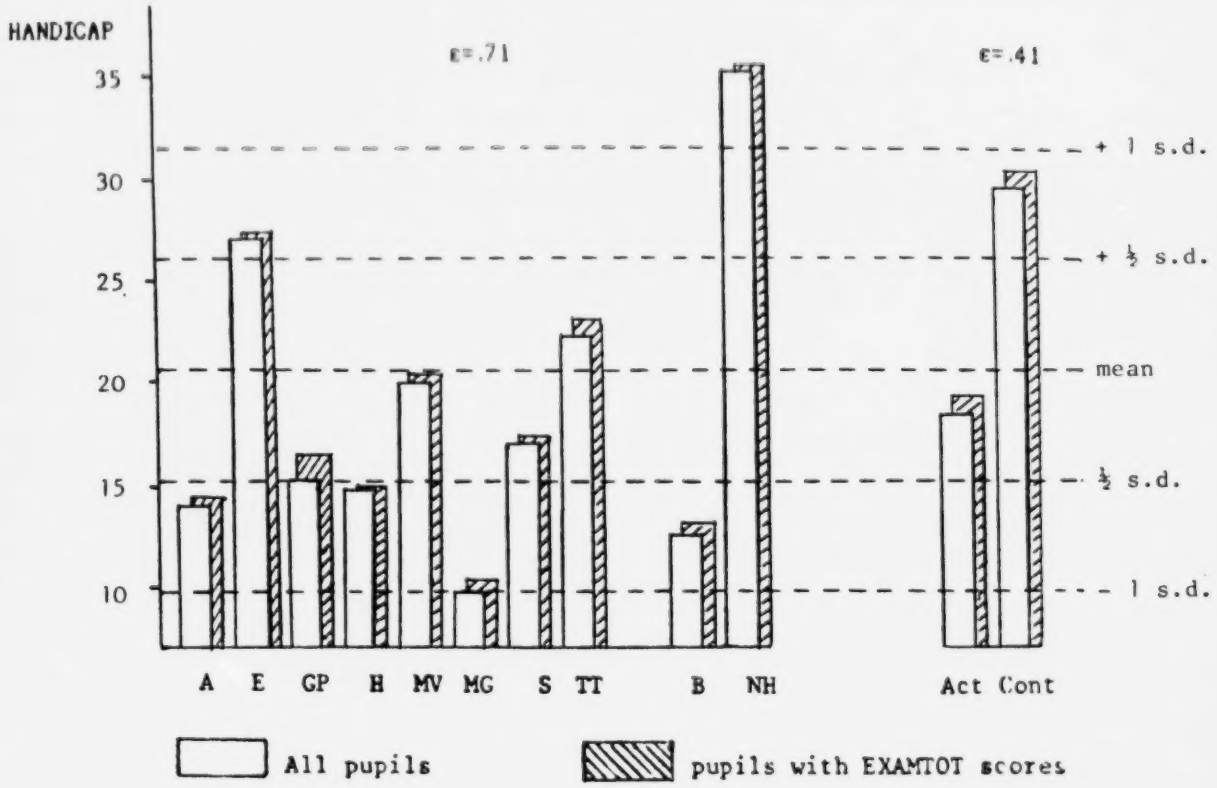


Figure 1.3. Mean scores of pupils in each school on HANDICAP.



To compensate for the differences in overall school effectiveness a further weighting was added to the Background Variable to produce a School Handicap Score, HANDICAP. The distribution of School Handicap Scores is shown in Figure 1.3. The eta values are very large, showing that schools varied massively in their intake and success with pupils. 50% of the overall variation in HANDICAP occurred between schools, and HANDICAP itself explained 55% of the variation in individual examination scores. The correlation between BACKGR and HANDICAP was over .92.

The Background Variable (BACKGR) and the School Handicap Score (HANDICAP) are used as controls in many of the analyses that follow. They allow school effects on science and sex roles to be examined, allowing for differences in school intakes and in overall school effectiveness. In particular they allow the action and control schools to be compared directly, allowing for the fact that their intakes are different.

1.3 Variables

In addition to those described above a number of other variables are used throughout this report. One of the main purposes of the further analyses reported here is to examine whether the GIST interventions were more or less successful with particular groups of pupils. These groups are defined in terms of social class, academic ability, initial sex stereotyping and initial attitudes to science.

The first two dimensions, social class and academic ability, have already been mentioned. Social class is measured either by SES (described above), or by a dichotomized variable, CLASS, again based on parental occupations. Children were considered middle class if *either* their father's *or* their mother's occupation fell in categories 4 or 5 (professional, semi-professional and white collar for fathers; professional or semi-professional for mothers). All other combinations were considered working class. For some purposes this dichotomized scale is more convenient than the ten-point variable.

Academic ability is measured by IQALL, the scores on intelligence tests administered just before transfer to secondary school. Again it is more convenient for some purposes to group pupils into those with low (less than 95) medium (95-105) and high (over 105) scores.

Sex stereotyping on entry to secondary school was measured on either a Gender or an Occupational Stereotype Inventory. These inventories and the scales derived from them are described in detail in an earlier paper (Kelly & Smail, 1986). Briefly, pupils had to go through a list of thirty behaviours or occupations three times, and rate their suitability for girls, for boys and for themselves. Three scales were derived from these ratings: SEXTYPE, the average difference between the suitability ratings each child gave for girls and for boys; FSELF, the average desirability for themselves of occupations or behaviours generally seen as more suitable for girls; and MSELF, the average desirability for themselves of occupations or behaviours generally seen as more suitable for boys. SEXTYPE is used to indicate the degree to which any child sees a distinction between the roles of males and females, while FSELF and MSELF indicate their own self-images as feminine and masculine.

It is sometimes confusing to have to deal with scales derived from two different inventories in this way. Moreover in third year the Gender Inventory was dropped, as many of its items were inappropriate for fourteen-year-olds. The Occupational Inventory was repeated with all pupils. To minimize the comparability problems a Joint measure of stereotyping in first year was derived, using the scores of 177 children at one school who had completed both inventories. This was done by (1) scaling the Gender scores to the same mean and standard deviation as the Occupational scores for the children who completed both inventories, (2) applying the same transformation to all the Gender scores, and (3) substituting the scaled Gender score for the Occupational score where no Occupational score was available. This Joint score is used, in a grouped form, to examine the effects of GIST interventions on pupils who were more and less sex-stereotyped when they entered secondary school.

Three attitude questionnaires - Scientific Curiosity, Image of Science and Scientific Activities - were administered to the first year pupils, and two of these (Scientific Curiosity and Image of Science) were repeated in third year. Eleven attitude scales were derived from these questionnaires (see Table 1.4). The construction and characteristics of these scales are described elsewhere (Smail & Kelly, 1984). For the present purposes the most important scales are PHYSCUR (desire to learn about physical science), LIKESCI (personal interest in science), SCIMALE (image of science as a masculine subject) and TINKERAC (previous participation in tinkering activities). Pupils were divided into groups on the basis of their initial scores on these scales, and the effects of GIST interventions explored within each group.

Table 1.4. Subscales of the Attitude to Science Questionnaires

Scientific Curiosity	
PHYSCUR	Desire to learn about physical science
NATSTCUR	Desire to learn about nature study
HUMBICUR	Desire to learn about human biology
TVSCICUR	Desire to learn about spectacular science
Image of Science	
SCIWORLD	The social consequences of science
LIKESCI	Personal interest in science
SCIENT	Image of scientists
SCIMALE	Science as a masculine subject
Scientific Activities	
TINKERAC	Participation in tinkering activities
BIOLSCAC	Participation in biological science activities
THEOSCAC	Participation in theoretical science activities

Where a questionnaire was administered twice, the question arises of whether it is better to analyse change scores or final scores. Change scores, being based on two measurements, generally have twice the error of final scores. If there were no initial differences between action and control schools it would therefore be preferable to analyse final scores only. However in the present study there were frequently pronounced differences between action and control schools on initial scores. For this reason change scores have been analysed wherever possible.

1.4 The Report

This report examines the differences between pupils in action and control schools on a variety of outcomes. Option choices are considered in Chapter 2, where the enrolment of girls and boys in physics, chemistry and technical crafts in action and control schools is documented. Attitudes to science were measured in both first and third year, and in Chapter 3 the changes in attitudes at action and control schools are compared. Sex stereotypes were also measured in first and third year, and changes in pupils' ideas about what is suitable for girls and for boys are explored in Chapter 4. In Chapter 5 we turn to children's ideas about the future. Differences between action and control schools on a variety of variables such as the scientific content of expected jobs, their image of the jobs of scientists and engineers, the vocational relevance and sex-typing of schools subjects and the domestic division of labour are discussed. Chapter 6 uses information from the follow-up survey of seventeen year-olds to study the lasting nature of any differences between children in action and control schools. Their ideas about physics and about sex roles are explored, as well as their present occupations and plans for the future. In Chapter 7 the focus switches from the action/control dimension to the individual school. Some schools were more successful than others at achieving the different aims of the project, and these differences between schools are explored here. Finally the overall impact of the GIST project, and its successes and failures, is discussed in Chapter 8.

2. Option Choices

2.1 Patterns within Schools

One of the main aims of the GIST project was to encourage more girls to continue with physical science and technical subjects when these became optional at school. However it did not prove easy to evaluate the success of our efforts in this direction. Option choices vary widely from school to school; within any one school they fluctuate from year to year. These variations can be attributed to the school traditions, the vagaries of the option systems, teaching strengths and weaknesses and fashions among the pupils. Many of these factors were beyond the influence of GIST.

In the Final Report on the project (Kelly *et al*, 1984) we tackled the problem of assessing our impact on option choices by comparing the percentage of girls and boys who took physics, chemistry and technical crafts in the GIST cohort with the percentages for previous years in the same school. We showed that in four of the action schools (Ashgrove, Edgehill, Moss Green and Tall Trees) a higher percentage of girls took physics in the GIST year than in any of the previous three years. However the same was true at both the control schools (Burnbank and New Hall) so this effect cannot be unambiguously attributed to the GIST interventions. In three of the action schools (Green Park, Moss Green and Tall Trees) a markedly higher proportion of girls took chemistry than in previous years, and this also occurred at one of the control schools (Burnbank). Slight improvements in girls' uptake of chemistry were recorded at three more action schools (Ashgrove, Meadow Vale and Suttonhill). Girls took substantially more technical craft subjects than in previous years at three action schools (Green Park, Meadow Vale and Moss Green), with a slight improvement at another two action schools (Ashgrove and Edgehill) but at neither of the control schools was there any change.

These results suggest that the GIST interventions may have had some slight effect on girls' choice of physical science and technical craft subjects, but that any changes were not dramatic. Boys' uptake of these subjects in the GIST cohort was generally in line with their choices in the same school in previous years, and did not show any distinct trends.

The data on each school has now been updated with information on uptake in the two subsequent years at each school. The extended charts are presented

in Figures 2.1 to 2.3. They enable us to see whether the GIST project had a sustained impact on option choice in any of the schools, or whether any effect was confined to the cohort with which we worked. A sustained impact might indicate some change in teachers' behaviour or in school atmosphere, while an effect that was confined to the GIST year group might signify changes in the pupils' attitudes and behaviours.

The Figures do not provide clear evidence for either hypothesis. At Ashgrove there were slight increases in girls' enrolments in all three subject areas in the GIST year, and in all three areas these fell back in the following year. The same was true in physics and chemistry at Tall Trees, and in technical crafts at Meadow Vale. In these schools and departments the project may have affected individual children's ideas without changing the teachers' behaviour in any lasting way. However at Moss Green the increase in girls' enrolments in physics continued over the next two years. So did the increase in girls' enrolments in technical crafts at Green Park, and to a much lesser extent at Edgehill. These are hopeful signs that there may have been some lasting changes in teaching styles and attitudes towards girls. Unfortunately these are the only examples of such sustained change. At Edgehill, and at both the control schools, girls' enrolments in physics fell back sharply the year following GIST, but then increased again. The same pattern occurred in chemistry at Green Park and in chemistry and technical crafts at Moss Green. It is possible that at these schools the initial changes were simply part of the normal year-to-year fluctuation in the uptake of subjects.

The percentages in Figures 2.1 to 2.3 were provided by the schools. They include children who joined the school between first and third year. This is true for all years, including the GIST cohort, and in this sense it is a fair comparison. However it is possible that the GIST interventions were more effective with children who had been exposed to them for the full three years than for children who had only been in an action school for a short time. The percentages for the GIST cohort were therefore reworked from the computerized data for the 1773 children who were in the GIST schools in first year and remained in the same school until fourth year. These percentages are shown in the Figures as an additional mark on the bar for the GIST cohort. They differ very little from the percentages for all

Figure 2.1. The percentage of girls and boys in the year group at GIST schools choosing physics in fourth year, 1980-1985

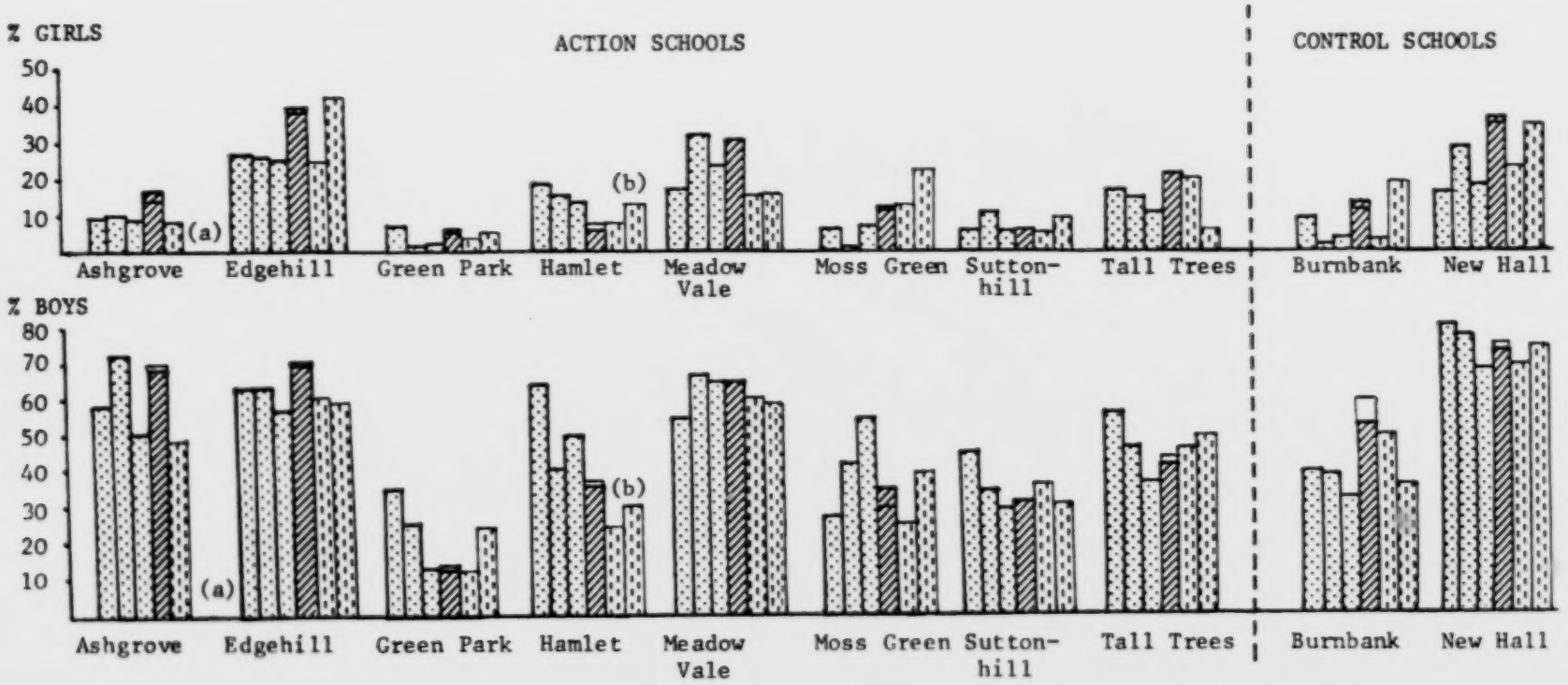
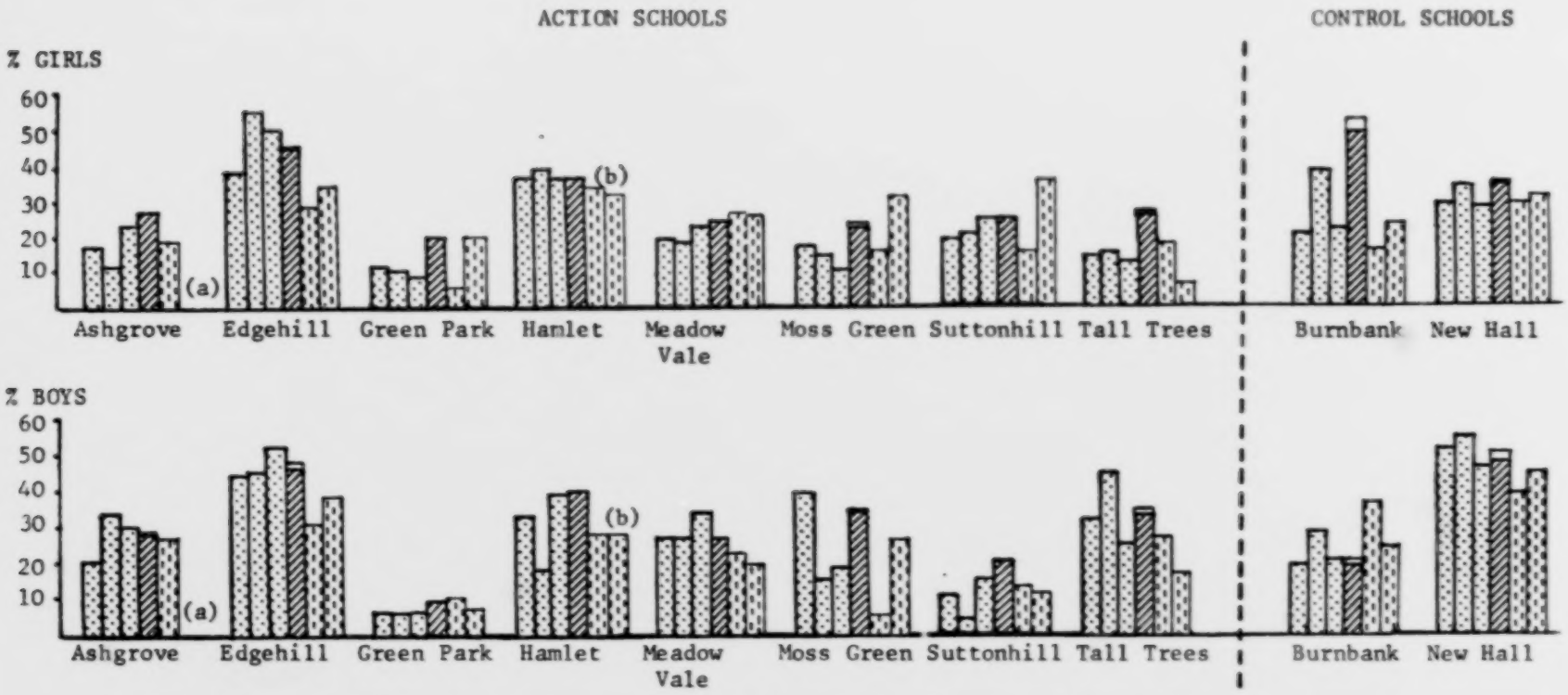


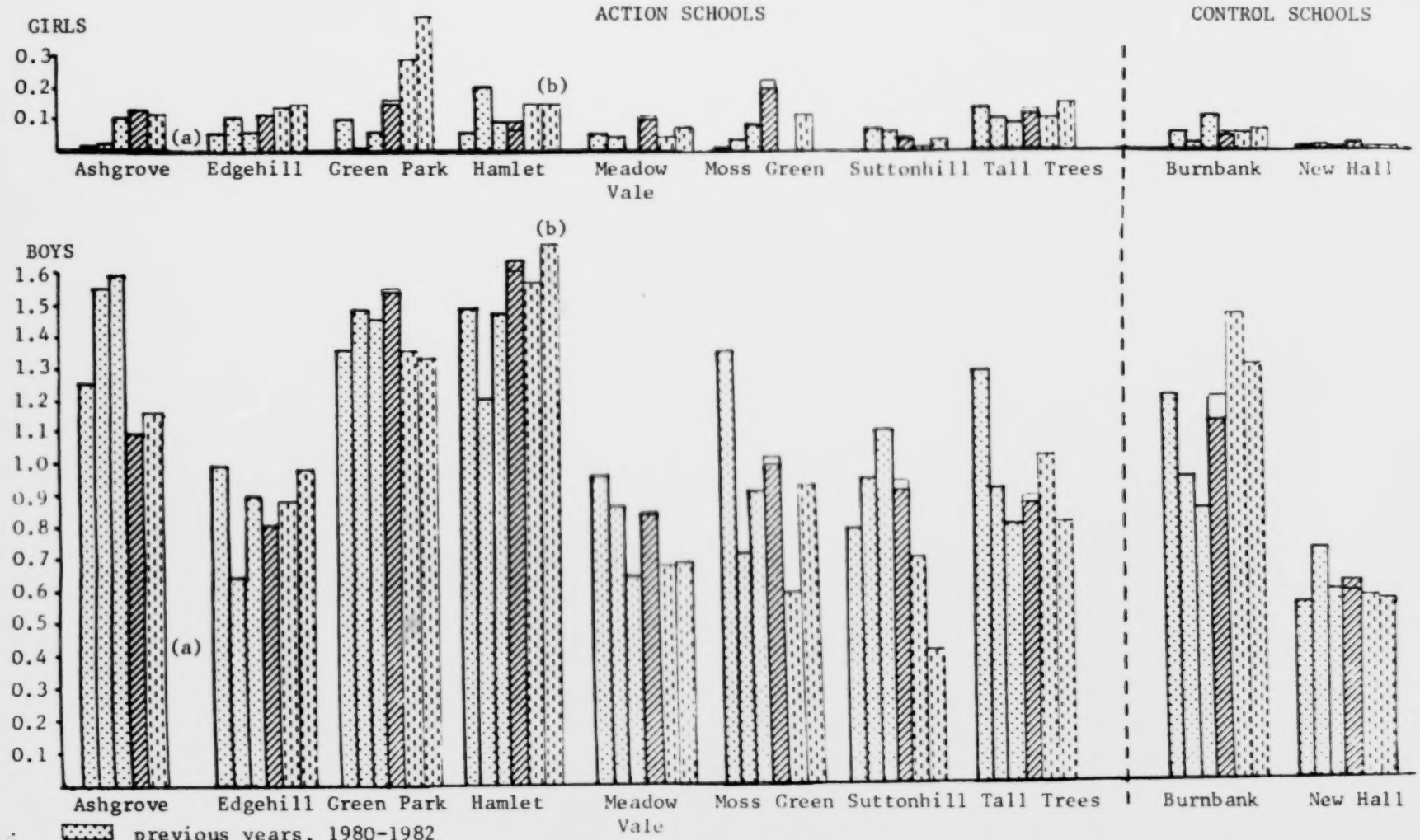
Figure 2.2. The percentage of girls and boys in the year group at GIST schools choosing chemistry in fourth year, 1980-1985



previous years, 1980-1982
GIST cohort, 1983
subsequent years, 1984-1985

(a) school became a sixth form college; no fourth year pupils
(b) school amalgamated with another; different catchment area

Figure 2.3. The average number of technical craft subjects taken by girls and boys at GIST schools in fourth year, 1980-1985



(a) school became a sixth form college; no fourth year pupils

(b) school amalgamated with another; different catchment area

children. All the discrepancies are small, and do not affect the points made in the previous discussion.

2.2 Action and Control Schools

One of the striking features of Figures 2.1 to 2.3 is the differences between schools. For example, high proportions of girls took physics at Edgehill, Meadow Vale and New Hall, compared to minuscule numbers at Green Park. A knowledge of the schools suggests that a large part, but not all, of this variation can be attributed to differences in intake. Schools in suburban areas typically had more pupils, of both sexes, taking physics and chemistry, and fewer boys taking technical crafts, than schools in the inner city. This impression is confirmed by Table 2.1, which shows the individual-level correlations between taking physics, chemistry and technical craft and the composite variables which control for social background, BACKGR and HANDICAP. Girls' choice of technical craft subjects is virtually unrelated to their social background, but all the other correlations are substantial and highly significant.

Table 2.1 Zero order correlations between social background variables and taking physical science and technical craft subjects.

	BACKGR		HANDICAP	
	Girls	Boys	Girls	Boys
Physics	.36***	.46***	.38***	.47***
Chemistry	.36***	.42***	.30***	.40***
Technical Crafts	−.03	−.26***	−.05	−.34***

*** correlation significant beyond the 0.1% level

The relationship between being in an action or a control school and taking physics, chemistry and technical crafts is explored statistically in Table 2.2. This gives the eta coefficients (derived from a multiple classification analysis) for the strength of the relationship between taking each subject and being in an action school, together with the significance of the effect (from an analysis of variance) and a sign to indicate whether pupils are more or less likely to take the subject in an action school. The Table shows that, on a simple comparison, both girls and boys were significantly more likely to continue with physics and chemistry in control schools than in action schools. On the other hand both sexes were more likely to continue with technical crafts at action schools than at control schools.

Table 2.2 Eta coefficients for the size of the relationship between taking physical science and technical craft subjects and being in an action or control school

	Girls	Boys
Taking physics		
No covariates	-.13***	-.18***
Covarying BACKGR	-.06	-.13***
Covarying HANDICAP	.05	-.01
Taking chemistry		
No covariates	-.09*	-.11***
Covarying BACKGR	-.03	-.07*
Covarying HANDICAP	.05	.04
Taking technical craft		
No covariates	.10**	.17***
Covarying BACKGR	.10**	.14***
Covarying HANDICAP	.10**	.05

Positive signs indicate greater uptake of subjects in action schools than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

However this bald picture is misleading. Children in control schools, came from more advantaged backgrounds and attended more effective schools, on average, than children in action schools (Chapter 1). Moreover both the Background Variable and the School Handicap Score were strongly related to choice of physics, chemistry and, for boys, technical crafts (Table 2.1). When the School Handical Score was covaried out of the relationsnip between being in an action or control school and subject choice all the coefficients, with the exception of girls' choice of technical crafts, become non-significant. Although the relationship was not large, girls were significantly more likely to continue with technical crafts in action schools than in control schools. After allowing for differences in school intakes and effectiveness there was virtually no difference between action and control schools in pupils' choice of physics and chemistry.

Overall then the project seems to have had virtually no effect on pupils' choice of subjects to study in fourth and fifth year. The only exception to this is that girls in action schools were more likely to continue with technical crafts than their counterparts in control schools.

2.3 Different Groups of Children

This analysis suggests that the GIST project was not very successful in encouraging more girls to continue with physical science and technical subjects when these became optional at school. It is possible that the interventions were more effective with some groups of girls than with others. This issue is explored in Table 2.3, which shows the relationship between being in an action or control school and continuing to study physical science and technical crafts for children of differing class backgrounds, academic ability, sex-typing and attitudes on entry to school.

By contrast with the small and non-significant relationships for physics and chemistry enrolments shown in Table 2.2, the picture here is quite dramatic. Although being in an action school was unrelated to subject choice for working class pupils, both middle class girls and middle class boys were more likely to continue with physics and chemistry if they were in an action school than if they were in a control school (Table 2.3(a)). Being in an action school was also positively related to continuing with technical crafts for both girls and boys, but this relationship was weak and not significant for either middle class or working class pupils.

Significant effects also appeared when the pupils were divided into groups based on academic ability at transfer to secondary school (Table 2.3(b)). High IQ girls in action schools were more likely to continue with physics than their counterparts in control schools. Being in an action school had inconsistent effects on girls' choice of chemistry. Low IQ girls were less likely to continue with chemistry in action schools, while medium IQ girls were more likely to continue and being in an action school made little difference to high IQ girls' choice of chemistry.

Similar patterns were evident when the data was analysed by scores on the most closely related of the cognitive tests administered in first year (Table 2.3(h)). Action-girls with high scores on the physics part of the initial science tests were more likely to continue with physics than comparable control-girls; action-girls with high scores on the whole of the initial science test (there was no chemistry component) were more likely to continue with chemistry than comparable control-girls. However among low-scoring pupils there was a slight tendency for those in action schools to be less likely to continue with physical science than those in control schools. And

Table 2.3 Eta coefficients for the size of the relationship between continuing physical science and technical crafts and being in an action or control schools, after allowing for School Handicap Score, for children who differ in initial characteristics.

	Girls			Boys		
	Physics	Chem	Tech Craft	Physics	Chem	Tech Craft
(a)CLASS						
Working class	-.01	.00	.09	-.06	.00	.05
Middle class	.22**	.18*	.12	.15*	.21**	.08
(b)IQALL						
Low	-.01	-.24***	.10	-.11	.03	-.01
Medium	.06	.24**	.09	-.14	-.01	-.03
High	.17*	.08	.04	.05	.01	.08
(c)SEXTYPE						
Low	.10	.01	.06	.00	.09	.08
Medium	.04	.08	.11	-.02	.02	.01
High	.03	.11	.13	.01	.01	.05
(d)LIKESCI						
Low	.20**	23**	.15	.07	.08	.15
Medium	-.01	.00	.05	-.04	.05	.03
High	.04	.02	.12	-.01	.06	.03
(e)PHYSCUR						
Low	.04	.04	.11	-.02	.01	.25*
Medium	-.02	-.05	.10	-.01	.08	.08
High	.19*	.25*	.06	.00	.04	-.03
(f)SCIMALE						
Low	.02	-.16	.19	.03	.09	.09
Medium	-.02	.02	.14*	.00	.04	-.05
High	.10	.10	.17	.04	.02	.18*
(g)TINKERAC						
Low	.10	.08	.11	-.08	-.11	.21
Medium	.06	.08	.09	-.02	.10	.08
High	.09	.27	.19	-.01	.05	.00
(h)Cognitive tests	Physics	Science	Spatial	Physics	Science	Spatial
Low	-.11	-.08	.14*	-.16	.02	-.03
Medium	.01	.01	.06	.02	.00	.05
High	.23**	.20**	.11	.03	.13	.03

Positive signs indicate greater uptake of subjects in action schools than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

it was among girls with the lowest initial scores on the spatial test that being in an action school was most closely related to continuing with technical crafts.

The data was also analysed within groups of pupils with different degrees of initial sex-typing, as measured by SEXTYPE (Table 2.3(c)). It was hypothesized that less sex-typed children might be more receptive to the message being put forward by GIST. However the relationship between being in an action school and choosing physical science or technical craft was not significant within any of these groups. The interventions did not seem to be any more or any less likely to affect the choice of children who were comparatively stereotyped in their thinking as compared to those who were more egalitarian.

It was similarly hypothesized that pupils with positive initial attitudes to science, or with experience of science-related activities, might have a foundation of knowledge and interest on which GIST could build. Table 2.3(d), (e), (f) and (g) show the relationship between being in an action or control school and choosing physical science or technical craft for pupils with different initial attitudes to science. There are some significant relationships. The interventions seem to have been most effective in encouraging enrolment in physics and chemistry among girls with low initial liking for science and those with high curiosity about physical science. However it is hard to know how to interpret these seemingly inconsistent results, so perhaps they are merely chance variations.

3. Attitudes to Science

3.1 Changes in Attitudes

GIST hoped to affect not only pupils' enrolments in science, but also their attitudes towards science. Attitudes to science were measured by three questionnaires, as described in Section 1.3. Two of these, the Image of Science and the Scientific Curiosity questionnaires, were administered both in first and third year. Eight scales were derived from these two questionnaires. In this chapter I will explore the changes in pupils' scores on these eight scales, and the differential changes in action and control schools.

Figure 3.1 shows the average changes on each scale in action and control schools. It is clear from this Figure that attitudes to science generally declined, in both action and control schools, between first and third year. The only exceptions were that interest in human biology increased, particularly among girls, and science came to be seen by both sexes as less of a male subject. The steepest decline in attitudes was in girls' general liking for science.

It is not easy to assess differences in attitude changes between action and control schools from the Figure because of the differences in initial scores. Inspection suggests that there was a small but consistent tendency for the attitude changes to be more negative in control schools than in action schools. However initial attitudes were generally slightly better in action schools than in control schools, and this may confuse the picture.

The relationships between changes in attitudes to science and initial attitudes for girls and boys are shown in Table 3.1. All the correlations are strongly negative. In other words the steepest decline in attitudes occurred among pupils whose attitudes were best initially. This is as would be predicted from regression to the mean effects. Table 3.2 shows the relationships between initial attitudes and changes in attitudes and the control variables, BACKGR and HANDICAP. These correlations are much smaller, although many of them are still significant. By and large children from more advantaged backgrounds had more positive attitudes to science in first year and less negative changes between first and third year than children from less advantaged backgrounds. The main exceptions are that

Figure 3.1. Changes in attitudes to science between first and third year.

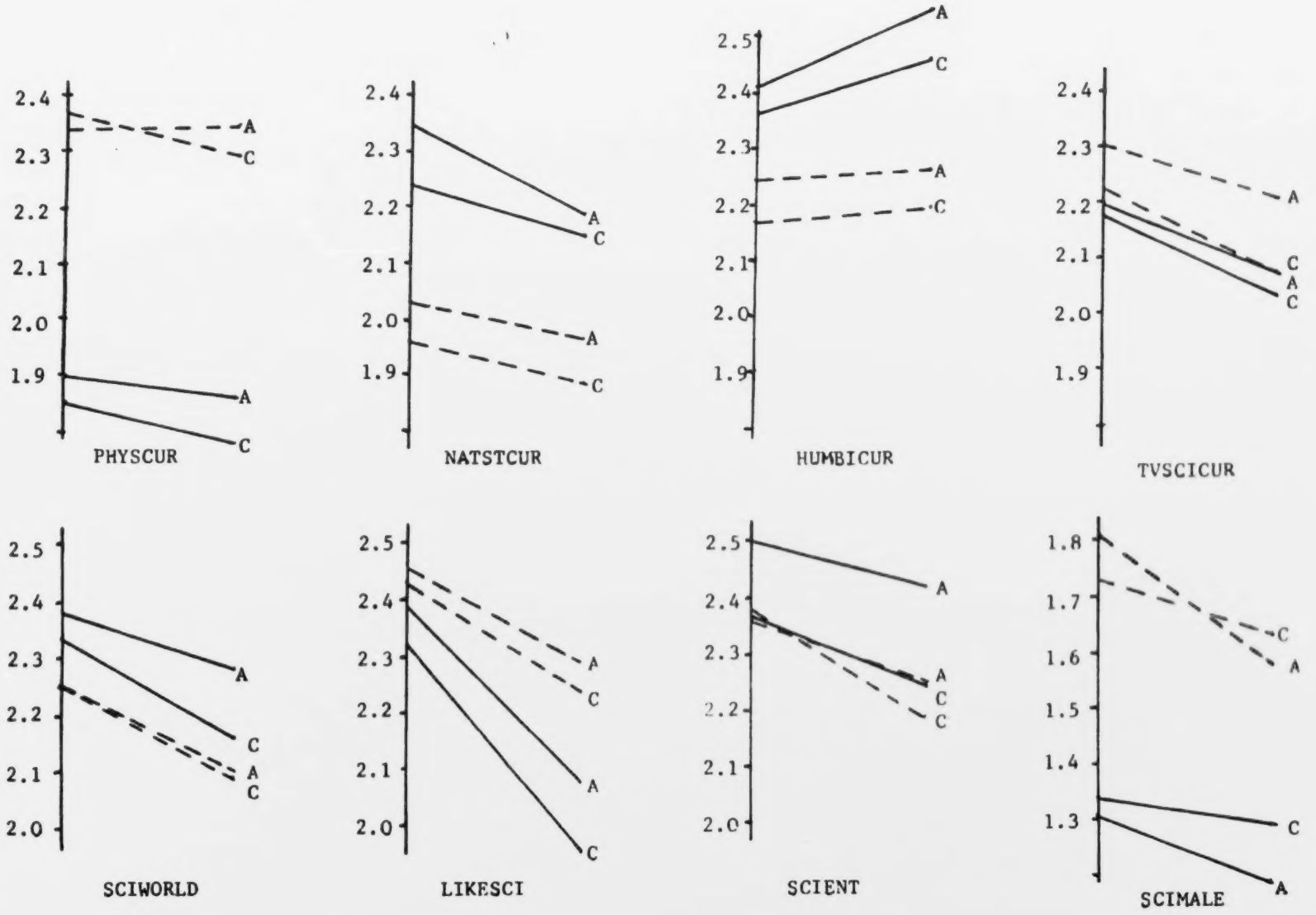


Table 3.1 Zero order correlations between changes in attitudes to science and initial attitudes for girls and boys

	girls	boys
Scientific Curiosity		
PHYSCUR	-.43***	-.49***
NATSTCUR	-.53***	-.56***
HUMBICUR	-.55***	-.55***
TVSCICUR	-.49***	-.48***
Image of Science		
SCIWORLD	-.57***	-.60***
LIKESCI	-.53***	-.53***
SCIENT	-.57***	-.58***
SCIMALE	-.67***	-.64***

*** correlation significant beyond the 0.1% level

advantaged boys were less enthusiastic about nature study in first year; and advantaged pupils' views of science as a masculine subject decreased less sharply between first and third year (although this is perhaps not surprising as their initial scores were considerably lower).

The size and significance of the relationships between changes in attitudes to science and being in an action or control school are explored in Table 3.3. When no allowance was made for other factors there was very little connection between being in an action school and change on any of the

Table 3.2 Zero order correlations between background variables and initial scores and changes in score on attitude to science scales for girls and boys

	Initial scores				Changes in scores			
	BACKGR		HANDICAP		BACKGR		HANDICAP	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Scientific Curiosity								
PHYSCUR	.09**	.12***	.08*	.12***	.15***	.05	.13***	.05
NATSTCUR	.10**	-.08*	.10**	-.09*	.09*	.11**	.09*	.13***
HUMBICUR	.08*	.04	.06	.02	.04	.09*	.02	.09*
TVSCICUR	.21***	.07*	.20***	.04	.03	.01	.02	.02
Image of Science								
SCIWORLD	.13***	.15***	.13***	.14***	.03	.05	.01	.05
LIKESCI	-.04	.07	-.06	.04	.13***	.14***	.10**	.12**
SCIENT	.16***	.21***	.12***	.19***	.05	.01	.03	-.00
SCIMALE	-.33***	-.19***	-.29***	-.19***	.11**	.06	.12***	.08*

* correlation significant beyond the 5% level
** correlation significant beyond the 1% level
*** correlation significant beyond the 0.1% level

Table 3.3 Eta coefficients for the size of the relationship between changes in attitudes to science and being in an action or control school.

	Girls	Boys
Science Curiosity		
Changes in PHYSCUR		
no covariates	.03	.07
covarying initial score	.05	.05
covarying initial score and BACKGR	.10**	.07*
covarying initial score and HANDICAP	.16***	.11**
Changes in NATSTCUR		
no covariates	-.05	.01
covarying initial score	.00	.04
covarying initial score and BACKGR	.04	.05
covarying initial score and HANDICAP	.10**	.08*
Changes in HUMBICUR		
no covariates	.03	-.01
covarying initial score	.06	.03
covarying initial score and BACKGR	.08*	.04
covarying initial score and HANDICAP	.11**	.07
Changes in TVSCICUR		
no covariates	.02	.04
covarying initial score	.03	.07*
covarying initial score and BACKGR	.06	.08*
covarying initial score and HANDICAP	.12**	.11**
Image of Science		
Changes in SCIWORLD		
no covariates	.06	.01
covarying initial score	.09**	.01
covarying initial score and BACKGR	.11***	.02
covarying initial score and HANDICAP	.16***	.06
Changes in LIKESCI		
no covariates	.05	.02
covarying initial score	.08*	.03
covarying initial score and BACKGR	.11***	.06
covarying initial score and HANDICAP	.15***	.10**
Changes in SCIENT		
no covariates	.04	.05
covarying initial score	.11***	.04
covarying initial score and BACKGR	.15***	.06
covarying initial score and HANDICAP	.19***	.10**
Changes in SCIMALE		
no covariates	.08*	.09*
covarying initial score	.11***	.05
covarying initial score and BACKGR	.15***	.06
covarying initial score and HANDICAP	.20***	.08*

Positive scores indicate more desirable attitude changes in action than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

attitude to science scales. Only for viewing science as a masculine subject (SCIMALE) were the attitude changes significantly better in action schools than in control schools, and even there the relationship was small. However when allowance was made for initial scores, and the Background Variable or School Handicap Score, considerably stronger relationships were revealed. Girls' attitude changes were significantly better in action schools than in control schools on all scales, and the same was true on most scales for boys. In all cases being in an action school was more strongly related to changes in girls' attitudes than to changes in boys' attitudes.

The eta coefficients for change in attitudes are considerably larger and more significant than those for enrolments in physical science and technical craft described in the previous chapter. This suggests that GIST was more effective in altering children's attitudes than in altering their option choices. Perhaps this result was to be expected. Option choices are affected by many extraneous factors, such as the way the option system is structured and who is teaching a subject. Attitude changes may be a 'purer' measure of the effect of GIST interventions. In this context it is noteworthy that the largest differences between girls' attitudes in action and control schools occurred on the image of a SCIENT and SCIMALE subscales, dealing respectively with the image of a scientist and with the extent to which science is seen as a male subject. Both of these can be directly related to interventions such as taking women scientists into schools and trying to produce a more 'girl-friendly' science.

The attitude changes on different scales are of course not independent. They were all derived from data on the same pupils, and may all be manifestations of the same underlying trend. This trend seems to be for more positive (or less negative) changes in attitude in action schools than in control schools, especially for girls.

3.2 Different Groups of Children

As with enrolments, we should consider the possibility that some groups of children may have benefited more than others from the GIST interventions. This possibility is explored in Table 3.4. The Table shows that, for both girls and boys, there was a tendency for the difference between action and control schools to be larger among middle class than among working class

Table 3.4 Eta coefficients for the size of the relationship between changes in attitude scales and being in an action or control school, after allowing for School Handicap Score, for children who differ in initial characteristics.

	PHYSCUR	NATSTCUR	HUMBICUR	TVSCICUR	SCIWORLD	LIKESCI	SCIENT	SCIMALE
Girls								
(a)CLASS								
working class	.08	.12*	.08	.05	.12*	.10*	.11*	.19***
middle class	.31***	.16*	.12	.21**	.22***	.24***	.26***	.19**
(b)IQALL								
low	.15	.10	.09	.18*	.06	.07	.10	.16**
medium	.10	.19*	.01	.10	.22**	.31***	.29***	.20**
high	.26***	.03	.15*	.21**	.21**	.13	.22***	.15**
(c)Initial attitude								
low	.17**	-.04	.32***	.08	.15	.20*	.07	.40**
medium	.19*	.01	.07	.15	.13	.12	.33***	.28***
high	.09	.23***	.07	.20*	.28***	.22**	.26***	.20***
Boys								
(a)CLASS								
working class	.01	.06	-.04	.10	-.01	.06	.01	.04
middle class	.21**	.08	.18*	.15	.22**	.25**	.26***	.12
(b)IQALL								
low	.03	-.05	-.09	.04	.00	-.01	.00	.05
medium	.14	.18*	.05	.14	.01	.04	.18*	.11
high	.19**	.22***	.24***	.17*	.23***	.23***	.18**	.11
(c)Initial attitude								
low	.44***	.05	.12	.04	.07	.15	.15*	.10
medium	.02	.11	.06	.16*	.06	.04	.22**	.02
high	.16*	.15	.05	.16*	.13	.12	.00	.25**

Positive scores indicate more desirable attitude changes in action than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

children. For boys there was also a distinct tendency for high ability pupils to benefit more than others from exposure to GIST. These patterns are similar to those for enrolments, where it was noted that the GIST interventions were most effective with pupils who already possessed personal resources of class or ability.

Table 3.4(c) shows the differences between action and control schools among pupils who differ in initial attitudes. Although there are many large and

significant effects, there is little coherent pattern to these. It is not possible to make general statements to the effect that GIST was more influential with pupils who were already favourably disposed towards science; or conversely, that it succeeded in awakening an interest among pupils with poor initial attitudes. Again this conclusion is similar to that for enrolments, where the effectiveness of the interventions was largely independent of initial attitudes to science.

4. Sex Stereotyping

4.1 Job Suitability Ratings

One of the major interventions of the GIST project was VISTA, a programme of visits to schools by women working in scientific and technical jobs. A smaller programme of visits by men working in traditionally female jobs was also mounted, and discussions were held about sex stereotyping in general and in career choice in particular. In addition information was supplied about women's achievements in science. The aim of these interventions was to suggest to children that it was acceptable for people to take up occupations which were not traditionally associated with their sex, and that these could be personally rewarding.

Children's views about occupations were measured by the Occupational Stereotype Inventory. 773 children (591 in action schools and 214 in control schools) completed this Inventory twice, once in first year, and again in third year. They were asked to rate thirty jobs, first for their suitability for girls, then for boys, and finally to indicate how much they would like the job themselves. Each rating was made on a five point scale, from 5 ('very suitable' or 'I'd like it a lot') to 1 ('very unsuitable' or 'I'd hate it'). The average rating given by girls and boys to each job in first year is reported in an earlier paper (Kelly & Small, 1986). There were few surprises in these ratings, with jobs such as 'miner' and 'making cars in a factory' being seen as much more suitable for boys than for girls, while the reverse was true for jobs such as 'model' and 'looking after children'. Self-ratings followed a similarly traditional pattern. Boys were noticeably more stereotyped than girls.

The differences between mean ratings in action and control schools in first year were mainly small and insignificant. Only two (out of a possible 180) differences were greater than half a point: action-girls were less likely than control-girls to want to be a disc jockey, and thought it less suitable for boys to be nurses. The limited extent of these initial differences suggest that it is valid to compare changes in ratings in control and action schools, as they are starting from approximately the same point.

The way that children's ratings changed between first and third year in action and control schools is explored in Tables 4.1 and 4.2. It is clear

Table 4.1 Changes between first and third year in girls' ratings of the suitability of various jobs.

	For girls			For boys			For self		
	Act	Cont	Diff	Act	Cont	Diff	Act	Cont	Diff
Librarian	.11	.01	.10	.38	.19	.19	-.46	-.44	-.02
Police officer	.37	.10	.27	.09	.10	-.01	.06	-.05	.11
Electrician	1.15	.23	.92	.04	.16	-.12	.66	.01	.65
Social worker	.87	.98	-.12	-.03	-.24	.21	.67	.35	.32
Model	.23	.34	-.11	.89	.46	.43	-.06	.16	-.22
Computer operator	.28	-.04	.32	.31	.39	-.08	.05	-.39	.44
Taxi driver	.38	.23	.15	.12	.15	-.03	.13	.13	.00
Looking after children	.17	.22	-.05	.74	.05	.69	-.04	-.07	.03
Car park attendant	.19	.14	.05	.14	.20	-.06	-.12	-.29	.17
Teacher	.09	.04	.05	.25	.02	.23	-.49	-.50	.01
Cleaner	.26	.24	.02	.43	.16	.27	-.19	-.18	-.01
Making transistor radios in a factory	.70	.27	.43	.07	.23	-.16	.15	-.25	.40
Car mechanic	1.22	.31	.91	.05	.09	-.04	.71	-.10	.81
Secretary	.06	.17	.11	.58	.19	.39	-.31	-.10	-.21
Reading the news on TV	.41	.21	.10	.13	.21	-.07	.12	-.01	.13
Vet	.51	.40	.11	.14	.04	.10	.05	-.37	.42
Hairdresser	.19	.29	-.10	.68	.22	.46	.02	-.06	.08
Engineer	1.18	.49	.69	.07	.04	.03	.84	-.01	.85
Disc jockey	.69	.55	.14	.12	.02	.10	.20	.02	.18
Nurse	.15	.14	.01	1.06	.05	1.01	-.07	-.25	.18
Making cars in a factory	1.00	.43	.57	.10	.05	.05	.46	.01	.45
Mending typewriters	.60	.39	.21	.42	.28	.14	.01	-.21	.22
Ballet dancer	.18	.18	.00	.41	.01	.40	-.50	-.23	-.27
Manager of a large firm	.44	.40	.04	.05	-.13	.18	.35	.07	.28
Air pilot	.64	.20	.44	.11	.11	.00	.41	.27	.14
Scientist	.33	.19	.14	.14	.10	.04	-.02	-.55	.53
Making clothes in factory	.16	.26	-.10	.19	-.05	.14	-.24	-.23	-.01
Shop assistant	.04	.18	-.14	.24	-.02	.26	-.25	.04	-.29
Miner	.42	.15	.27	.15	.16	-.01	.09	.11	-.02
Doctor	.41	.21	.20	-.01	.01	-.02	.20	-.06	.26

Act - action schools; Cont - control schools; positive values indicate that suitablity ratings increased.

Diff - difference between changes in action and control schools; positive values indicate that suitability ratings increased more (or decreased less) in action than in control schools

Table 4.2 Changes between first and third year in boys' ratings of the suitability of various jobs.

	For girls			For boys			For self		
	Act	Cont	Diff	Act	Cont	Diff	Act	Cont	Diff
Librarian	.31	.17	.14	.25	.03	.22	-.15	.04	-.19
Police officer	.31	.14	.17	.12	-.03	.15	-.42	-.51	.09
Electrician	.59	.31	.28	.15	.00	.15	-.03	-.07	.04
Social worker	.85	.59	.26	.01	-.22	.23	-.28	-.06	-.22
Model	.26	.21	.05	.51	.66	-.15	.21	.23	-.02
Computer operator	.17	.25	-.08	.35	.18	.17	.06	.27	-.21
Taxi driver	.14	.25	-.11	.19	.19	.00	-.01	-.12	-.11
Looking after children	.22	-.14	.36	.39	.15	.24	.26	-.01	.27
Car park attendant	.02	-.05	.07	.29	.12	.17	-.09	-.24	.15
Teacher	.14	-.05	.19	.24	.19	.05	-.14	-.08	-.06
Cleaner	.27	.34	-.07	.15	-.14	.29	.08	-.06	.14
Making transistor radios in a factory	.49	.37	.12	.01	-.18	.19	-.38	-.67	-.29
Car mechanic	.69	.35	.34	.11	-.10	.21	-.06	-.15	.09
Secretary	.16	.12	.04	.38	.18	.20	.14	.07	.07
Reading the news on TV	.48	.08	.40	.10	.06	.04	.01	.07	-.06
Vet	.61	.39	.22	.06	-.08	.14	-.18	-.21	.03
Hairdresser	.21	.17	.04	.29	.30	-.01	.19	.04	.15
Engineer	.73	.29	.44	.08	-.22	.30	.03	.03	.00
Disc jockey	.77	.42	.35	.00	-.37	.37	-.01	.08	-.09
Nurse	.17	.12	.05	.78	.45	.33	.38	.20	.18
Making cars in a factory	.51	.36	.15	.13	-.04	.17	-.15	-.32	.17
Mending typewriters	.32	.56	-.24	.32	.08	.24	.04	-.30	.34
Ballet dancer	.23	.24	-.01	.25	.56	-.31	.03	.10	-.07
Manager of a large firm	.25	.23	.02	.09	-.10	.19	.11	.10	.01
Air pilot	.28	.03	.25	.10	-.13	.23	-.12	-.06	-.06
Scientist	.26	-.01	.27	-.03	-.10	.07	-.11	-.66	.55
Making clothes in factory	.28	.04	.24	.28	.04	.24	-.09	-.19	.10
Shop assistant	.23	-.07	.30	.15	-.03	.18	.23	-.08	.31
Miner	.26	.47	-.19	.28	-.11	.39	.02	-.11	.13
Doctor	.30	.13	.17	.05	-.11	.16	.23	.17	.06

Act - action schools; Cont - control schools; positive values indicate that suitablity ratings increased.

Diff - difference between changes in action and control schools; positive values indicate that suitability ratings increased more (or decreased less) in action than in control schools

clear that the greatest changes were in action-girls' ratings of the suitability-for-girls of the jobs of car mechanic, engineer, electrician and making cars in a factory. The average action-girls suitability rating of each of these jobs increased by over 1.0. The corresponding change for control-girls was less than 0.5. This suggests that the interventions had a direct effect on how suitable girls thought it was for girls to take up these highly masculine and scientific jobs. Action-girls also showed much more favourable changes than control-girls in their suitability-for-boys rating of the job of nurse. Although smaller, there was a similar pattern of substantially larger increases in ratings from action-girls than from control-girls, in many other jobs considered non-traditional (e.g. making transistor radios in a factory and being an air pilot for girls and being a model, looking after children, being a secretary, hairdresser or ballet dancer for boys). These results indicate that the GIST interventions were effective in reducing children's stereotyping of a range of occupations.

Turning to self-ratings we find that action-girls showed markedly more positive changes than control-girls for the jobs of engineer, car mechanic, electrician, scientist, making cars in a factory, computer operator, vet and making transistor radios in a factory. All these jobs have some sort of scientific of technical component, and it is this which seems to be the focus of change, rather than the masculinity of the job. Jobs which were seen as masculine but not scientific (such as miner or taxi driver) were not affected. Jobs that were scientific but only slightly masculine (scientist, computer operator and vet) decreased in popularity among control-girls, but held constant among action-girls. This indicates that interest in scientific careers decreased among control-girls between first and third year, but that the GIST interventions were successful in arresting the decline among action-girls.

The figures for boys show fewer and less substantial differences between action and control groups. Action-boys changed more than control-boys in their assessments of the suitability of a girl becoming an engineer or a car mechanic -- but also in their assessment of the suitability of a girl reading the news on TV or being a disc jockey, not areas of particular concern to the GIST project. Action-boys changed their opinions about boys being a nurse more than control-boys, but they changed less about the suitability of boys being a ballet dancer. There was very little difference

between action-boys and control-boys in their self-ratings. Interestingly the largest differential was in changes in wish to be a scientist where, as with the girls, the ratings dropped sharply in control schools but changed little in action schools.

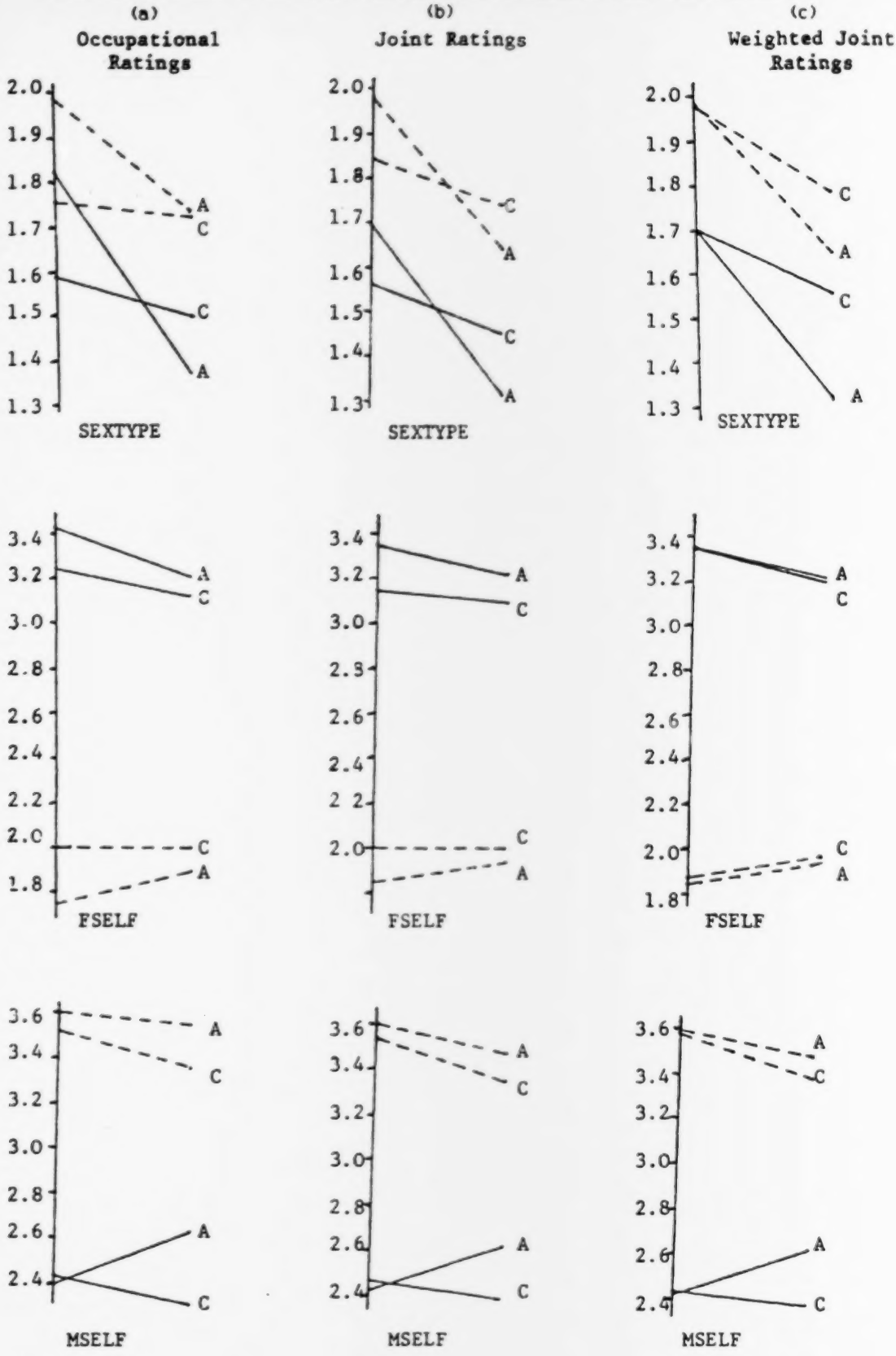
4.2 Stereotyping Scales

Three scales were derived from the Stereotyping Inventories. They were: SEXTYPE, a measure of sex-typing, based on the average difference in each child's ratings of the suitability of jobs for girls and for boys; FSELF, the extent to which traditionally feminine activities were preferred for self; and MSELF, the extent to which traditionally masculine activities were preferred for self. As described in Section 1.3, Occupational, Gender and Joint versions of each of these scales was available.

In the Final Report on the GIST project (Kelly et al, 1984) we explored the changes in pupils' stereotyping of occupations in action and control schools over the intervention period. We found that sex stereotyping declined much more steeply in action than in control schools. In addition action-girls became more willing to consider traditionally masculine jobs for themselves, and action-boys became more willing to consider feminine jobs. These results were obtained from separate first and third year data sets, so children who were present on one but not the other testing occasion were included in the averages. Figure 4.1(a) shows the same information, based only on the scores of children who completed the Occupational Stereotyping Inventory twice. The patterns are similar to those reported earlier.

It is clear from this Figure that there was a considerable discrepancy between the initial scores of children in action and control schools, particularly on the measure of sex stereotyping. In first year both girls and boys in action schools saw much greater differences between the suitability of jobs for girls and for boys than did the children in control schools. Children in action schools were also slightly more polarized than children in control schools, in terms of being more positive about sex-appropriate jobs for themselves, and more negative about sex-inappropriate jobs. These initial differences mean that it is impossible to unambiguously attribute the differential change in attitudes to the action programme.

Figure 4.1 Changes in stereotyping between first and third year



A Action-girls, N = 230-245 (Occupational), 438-477 (Joint)

C Control-girls, N = 81-83 (Occupational), 152-157 (Joint)

A Action-boys, N = 238-267 (Occupational), 481-551 (Joint)

C Control-boys, N = 67-73 (Occupational), 122-130 (Joint)

Figure 4.1(b) shows the same information using the Joint scales, derived from both Occupational and Gender Stereotype Inventories. This enabled scores from four more schools to be considered. In these circumstances the initial differences between action and control schools were reduced, but were still evident.

The problem of lack of comparability between action and control schools was tackled in two ways. The first was to divide the initial sex stereotyping scores into ten bands, and weight the distribution of pupils by band in the control schools to match that in the action schools. Thus more weight was attached to the scores, both initial and final, of the relatively few children in the control schools with high initial sex-typing, and less weight to the scores of their less sex-typed classmates. The results are shown in Figure 4.1(c).

The effects of the weighting are to remove almost completely the discrepancies between action and control schools in initial scores. The decline in sex-typing remained much more marked in action than in control schools, especially amongst girls. The tendency for action-girls to become more positive about masculine jobs for themselves also remained. However the trend for action-boys to become more positive than control-boys about feminine jobs for themselves disappeared when the differences in initial scores were controlled.

These results suggest that the GIST interventions had real effects on children's sex stereotyping, but that they were more effective with girls than with boys. The mean scores on the sex-typing measure declined for both sexes. But personal preference for jobs traditionally associated with the opposite sex only increased differentially among girls. There was a slight increase in boys' (very low) liking for traditionally female jobs, but this was equally marked in action and in control schools, and so cannot be attributed to GIST.

Inspection of the changes in sex-typing of individual jobs suggests that the reductions were greater in action than in control schools across a wide range of occupations. The effects were not confined to the jobs of electrician, car mechanic and engineer which were so outstanding in the analysis of changes in ratings. In addition to these jobs, sex-typing

reduced much more sharply in action schools than in control schools in girls' ratings of the jobs of nurse, looking after children, making transistor radios in a factory, making cars in a factory, air pilot, hairdresser, ballet dancer, secretary, model and computer operator. For boys the differences between the changes in sex-typing in action and control schools were generally smaller, but still in favour of the action schools. The largest differences were for making clothes in a factory, air pilot and scientist. There were no jobs for which the changes in sex-typing were markedly worse for action-girls than for control-girls, but sex-typing reduced more among control-boys than among action-boys for the jobs of ballet dancer and mending typewriters.

The second approach to compensating for the initial differences between action and control schools is to perform analyses of variance, controlling for initial values. Changes in stereotypes were strongly linked to initial scores, with zero-order correlations of -0.5 or more on all three scales (Table 4.3). This indicates that the greatest reductions in stereotyping occurred with children who were initially the most stereotyped. Such a relationship would be expected as a regression to the mean effect, and also because there is most scope for reductions in stereotyping amongst highly stereotyped pupils.

Table 4.3 Zero order correlations between changes in stereotyping and initial stereotypes for girls and boys.

	SEXTYPE		FSELF		MSELF	
	Girls	Boys	Girls	Boys	Girls	Boys
Occupational scales	-.55	-.60	-.51	-.53	-.54	-.58
Joint scales	-.56	-.68	-.58	-.60	-.65	-.64

All correlations significant beyond the 0.1% level

The relationships between the stereotyping scales, changes in those scales, and the control variables BACKGR and HANDICAP were much more modest (Table 4.4). Girls from more advantaged backgrounds tended to be less sex-typed and less enthusiastic about traditionally feminine pursuits than other girls. There was a slight tendency for them to be keener on traditionally masculine activities than less advantaged girls. Advantaged girls were also slightly more likely to decrease in sex-typing and in preference for feminine activities over the course of the project. For boys there was little

Table 4.4. Zero order correlations between background variables and initial scores and changes in scores on stereotyping measures for girls and boys.

	Initial scores				Changes in scores			
	BACKGR		HANDICAP		BACKGR		HANDICAP	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
SEXTYPE								
Occupational	-.08	-.02	-.15**	-.08	-.06	-.04	.02	.03
Joint	-.15***	.06*	-.17***	.02	-.11**	-.11**	-.05	-.04
FSELF								
Occupational	-.16***	-.08	.15**	-.03	-.14**	-.05	-.14**	-.06
Joint	-.16***	-.11***	-.14***	-.08*	-.14***	.05	-.13***	.04
MSELF								
Occupational	.01	-.11*	.03	-.13**	.01	-.08	-.06	-.10*
Joint	.08*	-.04	.09**	-.06	.03	-.07*	-.03	-.09*

* correlation significant beyond the 5% level
** correlation significant beyond the 1% level
*** correlation significant beyond the 0.1% level

relationship between background and sex-typing, but advantaged boys seemed to be less keen than other boys on both traditionally feminine and traditionally masculine roles. In addition they became slightly less masculine in their self-perceptions during the first three years of secondary school.

The effect of being in an action or control school on changes in the stereotyping measures is explored statistically in Table 4.5. The results confirm the pattern that appeared in Figure 4.1. Sex-typing among action-girls decreased much more than among control-girls, and among action-boys it decreased slightly more than among control-boys. Allowing for differences in intake and school effectiveness between action and control schools increased the size of the change in sex-typing that could be attributed to GIST interventions slightly for girls, and decreased it slightly for boys. When initial differences were taken into account, action-girls swung against traditionally feminine jobs more strongly than control-girls, but there was no difference between the changes in action and control-boys preferences for these jobs. Action-girls changed more positively than control-girls in their personal preference for traditionally masculine jobs, but again being in an action or a control school made no difference to boys' scores. Only the Joint scales are shown in Table 4.5 but the pattern was very similar when Occupational scales were analysed.

Table 4.5 Eta coefficients for the size of the relationship between changes in the stereotyping scales and being in an action or control school.

	Girls	Boys
Changes in SEXTYPE		
no covariates	.18***	.12***
covarying initial score	.12***	.07*
covarying initial score & BACKGR	.16***	.07**
covarying initial score & HANDICAP	.23***	.09**
Changes in FSELF		
no covariates	-.06	.05
covarying initial score	.02	-.01
covarying initial score & BACKGR	-.02	-.01
covarying initial score & HANDICAP	-.09*	-.01
Changes in MSELF		
no covariates	.14***	.05
covarying initial score	.13***	.06
covarying initial score & BACKGR	.14***	.05
covarying initial score & HANDICAP	.17***	.02

Positive scores indicate that
(a) SEXTYPE reduced more in action than in control schools
(b) FSELF and MSELF increased more (or decreased less) in action than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level.
*** difference between action and control significant beyond the 0.1% level

The lack of effect on boys' preferences, particularly on boys' preference for traditionally feminine jobs was disappointing, but not altogether surprising. One of the GIST interventions was to take male visitors in traditionally feminine jobs into schools. We were surprised at the time by the hostility shown by some of the boys to these men (see Kelly *et al*, 1984). It appears that a limited intervention like this has little effect on boys' dislike of 'feminine' jobs, and a much more systematic effort would be needed to overcome their prejudices. The action boys did became more permissive about what it was acceptable for girls and for boys to do, despite the lack of change in their personal preferences.

4.4 Different Groups of Children

The GIST interventions may not have been equally successful in altering stereotypes among all groups of children. Table 4.6 explores the effect of being in an action school for children in different social classes, for

academically able and less able children and for children with high, medium and low initial scores on the scales.

The project seems to have had by far the greatest impact on middle class girls. Their sex-typing scores decreased much more sharply in action schools than in control schools, and their preference for 'masculine' jobs increased more in action schools than in control schools. In addition middle class action-girls became more disenchanted with traditionally female jobs than middle class control-girls. The relationships between changes in stereotypes and being in an action school were smaller for working class girls, but still noticeable.

Middle class boys also seemed to benefit more than working class boys from being in an action school, with a greater reduction in sex-typing. But the difference between the effects for middle class and working class children was not as great for boys as for girls. In neither social class did action-

Table 4.6 Eta coefficients for the size of the relationship between changes in the stereotyping scales and being in an action or control school, after allowing for initial scores and School Handicap Score, for children who differ in initial characteristics.

	SEXTYPE		FSELF		MSELF	
	Girls	Boys	Girls	Boys	Girls	Boys
CLASS						
Working class	.12**	.04	-.05	-.04	.15**	-.06
Middle class	.50***	.17*	-.18**	-.00	.27***	.17**
IQALL						
Low	.06	.05	-.07	-.02	.07	-.03
Medium	.27***	.03	-.13	.07	.20**	.08
High	.36***	.18**	-.07	-.01	.20**	.09
Initial score						
Low	.21**	.19**	-.14	.05	.29***	.01
Medium	.34***	.08	-.12	.03	.20***	.10
High	.27***	.06	.01	-.08	.12	-.05

Positive scores indicate that
(a) SEXTYPE reduced more in action than in control schools
(b) FSELF and MSELF increased more (or decreased less) in action than in control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

boys develop significantly greater interest than control-boys in traditionally feminine jobs.

The interventions did not seem to have much impact on the stereotypes of low IQ pupils of either sex, but were successful in reducing the sex-typing of medium and high IQ girls and of high IQ boys. Medium and high IQ action-girls also became more favourably inclined than similar control-girls towards traditionally masculine jobs. However changes in attitudes towards traditionally feminine jobs were not significantly different in action and control schools for any group of pupils.

Sex-typing declined more among action-girls than among control-girls, irrespective of initial views on the subject. But only boys with low initial sex-typing scores changed significantly more in action than in control schools. It could be argued that these were the boys with the greatest predisposition towards sex-equality, and that the project nudged them further in a direction they were already heading. But the opposite argument applies to personal preference for 'masculine' jobs. There the project was most effective among girls with low or medium initial interest in these jobs. Perhaps the girls with high initial interest did not need the added stimulus provided by GIST to get them thinking about non-traditional occupations.

5. Looking to the Future

5.1 Career Plans

The GIST project tried to encourage pupils to think constructively about their future lives and to link their present actions to their future plans. So we emphasised the career implications of subject choices, and discussed the roles of women and men at work and in the home. This chapter presents some information on the way thirteen-year-old children think about their futures. The longer-term impact of the GIST project will be assessed in the following chapter.

In the third year questionnaires children were asked 'what sort of job do you think you will do when you grow up?'. Up to three possible responses to this question were coded, and these have been analysed in detail elsewhere (Kelly, 1988b). The expected occupations were strongly sex-typed, with boys picking occupations such as the armed forces, engineering, computing, electrician and car mechanic while girls envisaged themselves as hairdressers, nursery nurses, typists, nurses and teachers. Girls' greater willingness to say that technical careers are suitable for girls, and to consider such careers for themselves (Section 4.1) does not seem to extend to expecting to take them up.

However this is not the whole story. The data on expected occupations was coded to indicate the scientific or technical content of each job mentioned. A crude classification of 'none', 'some' and 'a lot' was employed. The results are shown in Table 5.1, for children in action and control schools. Where more than one expected occupation was mentioned, the one with the highest scientific content was coded. The Table shows beyond doubt that boys

Table 5.1 Percentage of girls' and boys' mentioning expected jobs with scientific or technical content in action and control schools

	Girls		Boys	
	Action	Control	Action	Control
Scientific content	%	%	%	%
none	43.7	51.4	34.6	32.7
some	38.9	35.8	17.0	17.3
a lot	17.4	12.8	48.3	50.0
N	471	148	511	98

expected more scientific occupations than girls. However girls in action schools were more likely than girls in control schools to expect a job with some or a lot of scientific content. The reverse was true for boys, where those in control schools were slightly more likely to expect a job with scientific content.

This relationship can be explored after controlling for background factors in the same way as in earlier chapters. To do this the scientific content of expected jobs was assigned the code 1, 2 or 3 (representing none, some and a lot respectively) and analysis of variance was used. The results are shown in Table 5.2. With no covariates, the relationship between being in an action school and expecting a scientific job did not reach the 5% level of significance for either girls or boys. However expecting a scientific job was weakly linked to home background and school handicap for both sexes (particularly boys). When these factors were controlled, the size of the relationships increased slightly. Allowing for differences in intake and for overall school effectiveness, girls in action schools were significantly more likely than girls in control schools to expect a job with some scientific content.

Table 5.2 Eta coefficients for the size of the relationship between the scientific content of expected job and being in an action or control school.

	Girls	Boys
Scientific content		
no covariates	.07	-.01
covarying BACKGR	.10*	.00
covarying HANDICAP	.13**	.03

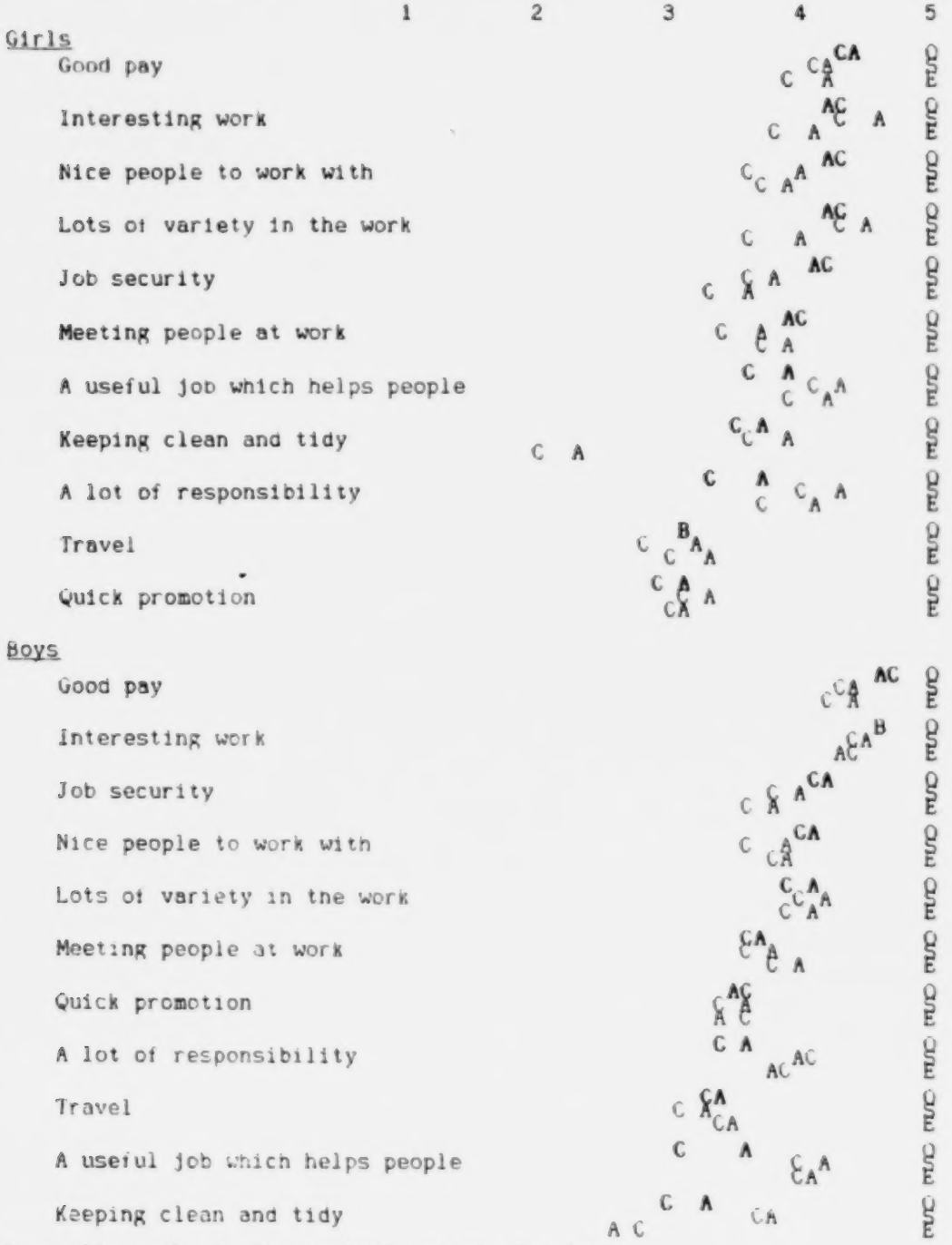
Positive coefficients indicate that children in action schools expected more scientific jobs than children in control schools.

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level

5.2 Scientists' and Engineers' Jobs

In third year pupils were asked to indicate how important it was for them that their job displayed a number of characteristics which are generally considered desirable. They were then asked to rate the jobs of scientist and engineer on the same eleven dimensions. The results are shown in Figure 5.1, with the characteristics ordered according to the importance children in

Figure 5.1. Girls' and boys' ratings of the desired characteristics of their own jobs, and of the jobs of scientist and engineer



A - action school; C - control school; B - both;
O - own job; S - scientist; E - engineer
Coding: own job: 5 very important; scientist/engineer: 5 definitely
4 probably
3 quite important; 3 not sure
2 probably not
1 not important 1 definitely not

control schools attached to them for their own jobs. Both girls and boys in action schools were more likely than their counterparts in control schools to want a useful job which helps people; girls in action schools were more likely to want responsibility than girls in control schools; and boys in action schools were more concerned with keeping clean and tidy. But with these few exceptions children in action and control schools attached similar importance to the various characteristics of jobs for themselves.

By contrast there were consistent differences in their ratings of the jobs of scientist and engineer. Girls in action schools rated these jobs higher on all dimensions than girls in control schools. The same was true of twenty of the twenty-two ratings by boys, although the differences between the responses from action and control schools were generally smaller for boys than for girls. Action-girls were particularly likely to see both science and engineering as interesting, with a lot of responsibility. Scientists were seen by action-girls as having nice people to work with, while engineers had a lot of variety in their work.

These results confirm the tendency described in Section 4.1 for action-girls to have more positive opinions of technical jobs than control girls. This trend can be directly attributed to GISF, and in particular to the VISTA programme of bringing women with technical and scientific jobs into schools to talk about their work, and to present positive role models to the girls.

The ratings for the perceptions of the job of scientist and engineer and for the desired characteristics of children's own jobs were made on different scales and cannot be directly compared. Nevertheless it is noticeable that the discrepancies between these ratings were greater for girls, especially when considering engineering, than for boys. These discrepancies were more marked for control girls than for action girls, which suggests that the interventions may have gone some way to convincing girls that engineering and science can provide the sort of work environment they are seeking.

5.3 School Subjects

In the third year questionnaires pupils were asked 'Do you think there are any subjects you could take in fourth and fifth year which might help you get a job when you leave school? Which subjects are these?' the replies are

Table 5.3 The percentage of girls and boys who think each subject might help them get a job

	Girls		Boys	
	Action	Control	Action	Control
	%	%	%	%
English	31.5	30.6	25.6	22.3
Maths	30.6	32.0	34.9	28.6
Physics	10.1	16.3	35.6	42.9
Chemistry	12.1	12.2	12.4	21.4
Biology	23.2	23.8	7.1	14.3
Science(other or unspecified)	12.6	9.5	9.8	7.1
Computer studies	8.1	9.5	15.9	19.6
Technical craft	5.7	3.4	28.5	25.0
Domestic craft	15.5	17.7	4.4	4.5
Languages	12.6	19.0	7.1	12.5
Secretarial,commerce	23.2	44.9	5.4	18.7
Personal, social	15.3	7.5	12.0	4.5
Sport	4.2	2.7	4.9	3.6
Other	12.3	8.8	11.0	8.0
All of them	5.7	4.1	3.4	2.7
None of them	4.2	3.4	8.5	7.1
N	406	147	410	112

Pupils were allowed to name up to three subjects, so percentages sum to more than 100%

shown in Table 5.3. English and mathematics, which were compulsory in all schools, were named by considerable numbers of both girls and boys. Other choices were more strongly differentiated by sex. Physics, computer studies, and technical craft were named much more frequently by boys than by girls; the reverse was true for biology, domestic crafts, languages and commercial subjects.

Turning to differences between action and control schools we see that physics was more likely to be mentioned by pupils in control schools. This was true for both girls and boys. Boys in control schools were also more likely to think that chemistry would help them to get jobs, while girls in action schools were slightly more likely to mention technical crafts. Perhaps the most striking differences were in languages and commercial subjects - not areas of direct concern to GIST - both of which were mentioned more frequently by children in control schools than by those in action schools.

Table 5.4 Eta coefficients for the size of the relationship between mentioning physical science or technical craft subjects as vocationally useful and being in an action or control school.

	Girls			Boys		
	Physics	Chem	Tech craft	Physics	Chem	Tech craft
no covariates	-.09*	.00	.05	-.06	-.11**	.03
covarying BACKGR	-.06	.01	.03	-.04	-.09*	.01
covarying HANDICAP	-.02	.01	.01	.01	-.06	-.06

Positive coefficients indicate that children in action schools were more likely to mention a subject as vocationally useful than children in control schools.

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level

As with the previous analyses, it is not really valid to compare results from action and control schools directly, because of their different intakes. Table 5.4 shows the size of the relationships between being in an action or control schools and naming physics, chemistry and technical crafts as useful subjects for getting a job, after allowing for differences in school intakes and effectiveness. When these factors were controlled, none of the relationships was significant. This suggests that the GIST interventions were not effective in persuading children that scientific and technical subjects were vocationally useful. Usefulness for getting a job is one of the main reasons given by children for choosing optional subjects (Kelly, 1988a). So the limited impact of the interventions on subject choice, as seen in Chapter 1, may perhaps be linked to the lack of success in persuading girls of the vocational relevance of physical science and technical craft subjects.

Third year pupils were also asked 'Are there any school subjects you think girls are better at than boys? What are they?' and 'Are there any school subjects you think boys are better at than girls? What are they?' The answers to these questions are shown in Table 5.5. Children in control schools were much more likely than children in action schools to mention traditional sex-typed craft subjects, and much less likely to give the egalitarian reply 'none'. They were also more likely to suggest that girls were better at languages and boys at mathematics and science, the traditional sex-typed academic subjects. It is noticeable that far fewer pupils, in both action and control schools, mentioned sex differences in

Table 5.5 Percentage of girls and boys in action and control schools naming subjects at which they think girls or boys are better.

	Girls		Boys	
	Action	Control	Action	Control
Girls are better at ...	%	%	%	%
languages (including English)	3.7	8.2	3.8	5.1
domestic crafts	43.7	86.8	56.5	87.2
other	16.5	17.0	14.4	23.9
none	47.4	27.0	37.6	23.1
N	437	159	444	117
Boys are better at ...				
maths, physical science	8.2	11.2	10.7	16.2
technical crafts	41.4	84.9	47.9	65.8
other	8.0	9.2	27.6	33.3
none	51.1	38.2	30.6	19.8
N	419	152	428	111

Pupils were allowed to name up to three subjects in each category, so percentages sum to more than 100%.

academic subjects than in craft subjects. Although the differences between action and control schools are marked, over half of all the children in action schools still thought that there were some differences between the sexes in performance in school subjects.

The differences between action and control schools are analysed further in Table 5.6, controlling for background factors in the usual way. Only mentions of craft subjects and the egalitarian response that there are no subjects at which one sex is better than the other are presented, as there were too few replies in any of the other categories to justify detailed analysis. Table 5.6 confirms that children in action schools were much less likely than their counterparts in control schools to be sex stereotyped about girls' and boys' abilities at school - although once again the effect was more marked for girls than for boys. The effect sizes reported in this Table are some of the largest in the Report, indicating that the interventions were particularly effective in changing children's views about sex differences in achievement. The percentages in Table 5.5 are directly comparable with the eta coefficients in the first line of Table 5.6, and comparison of the two provides a clear illustration of the size of the difference between action and control schools indicated by a given eta coefficient.

Table 5.6 Eta coefficients for the size of the relationship between saying that girls or boys are better at particular subjects and being in an action or control school.

	Girls		Boys	
girls are better at...	domestic craft	no subjects	domestic craft	no subjects
no covariates	.30***	.18***	.21***	.12*
covarying BACKGR	.32***	.20***	.22***	.13**
covarying HANDICAP	.34***	.24***	.23***	.14**
boys are better at...	technical craft	no subjects	technical craft	no subjects
no covariates	.27***	.12**	.11*	.10*
covarying BACKGR	.28***	.14***	.12**	.10*
covarying HANDICAP	.32***	.18***	.16***	.12**

Positive coefficients indicate that pupils in action schools were **less** likely to name craft subjects and **more** likely to say there were no subjects at which one sex was better than the other.

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

5.4 Sex Roles in the Home

In both first and third year pupils were asked to imagine that they were grown up and married with children of their own. They were then presented with a series of options to do with sex roles within the marriage. The responses of pupils who completed both questionnaires are presented in Table 5.7. Most pupils of both sexes thought that women should have jobs outside the home after the children were at school. But over twenty percent of the boys, compared to less than ten percent of the girls felt that married women should not have jobs at all. This proportion fell to only 1.1% among third year girls in action schools, 17% of whom did not want to give up their jobs at all. Most boys thought they should help with housework whether or not their wife was employed - although the extent of this 'help' was not specified. Perhaps surprisingly, this view was less common among girls - although girls were also less likely to say that men should not do housework in any circumstances. Third year action-girls were more likely than other girls to demand help from their husbands in all circumstances, but third year action-boys were less likely than other boys to be willing to provide such help.

Table 5.7 Percentage of girls and boys in action and control schools agreeing with certain views of women's and men's roles in the home

	Girls				Boys			
	1st year		3rd year		1st year		3rd year	
	Act	Cont	Act	Cont	Act	Cont	Act	Cont
Women should work...	%	%	%	%	%	%	%	%
all the time	17.5	16.6	17.2	8.9	16.5	9.3	14.2	11.2
when kids at school	76.9	76.4	81.7	85.4	63.5	70.1	65.8	65.4
not at all	5.6	7.0	1.1	5.7	20.0	20.6	20.0	23.4
Men should help in house...								
even if wife at home	36.7	41.4	47.0	43.9	51.3	55.5	43.5	54.5
if wife goes to work	54.4	48.4	50.4	53.5	36.6	32.7	44.1	33.6
not at all	8.9	10.2	2.6	2.5	12.1	11.8	12.4	11.8
Spouse should be								
cleverer than self	32.3	33.1	23.6	33.8	6.4	4.7	9.6	8.4
about the same	64.6	60.1	74.5	64.9	76.2	81.3	78.6	78.5
less clever than self	3.1	6.8	1.9	1.4	17.4	14.0	11.9	13.1
N	424-349	157-148	424-349	157-148	471-345	110-107	471-345	110-107

The final question in this section asked children if they wanted their husband or wife to be cleverer than them, less clever, or about the same. Almost a third of first-year girls wanted their husbands to be cleverer than them, but this proportion fell to a quarter among action-girls in third year. Many more boys than girls wanted their spouse to be less clever than themselves, although this proportion was low for both sexes.

The differences between action and control schools in the way pupils' views on sex roles in the home developed between first and third year are shown in

Table 5.8 Eta coefficients for the size of the relationship between changing ideas about sex roles in the home and being in an action or control school.

	wife's work		husband's help		spouse's ability	
	girls	boys	girls	boys	girls	boys
no covariates	.08	-.01	.04	-.03	-.09	.03
covarying BACKGR	.08	.00	.04	-.04	-.09*	.02
covarying HANDICAP	.10*	.03	.04	-.05	-.08	-.01

* difference between action and control significant beyond the 5% level

Positive coefficients indicate that children in action schools changed more than children in control schools towards (1) wanting wives to work (2) wanting husbands to help (3) wanting cleverer spouses.

Table 5.8. Only two differences were significant. Girls in action schools became more committed to employment than girls in control schools. And girls in action schools became less likely to want a cleverer spouse. Once again the GIST interventions seem to have had more impact on girls than on boys. And it is their views of women's role, rather than men's, which has altered.

6. Age Seventeen

6.1 Current Activities

In October 1986 follow up questionnaires were sent to all members of the GIST cohort, using addresses provided by the schools. The questionnaire enquired into their current work and/or study (one year after reaching the statutory school-leaving age), their plans for the future and their reflections on their schooling. Non-respondents were sent a reminder letter, followed by a second copy of the questionnaire.

The final response rate of 57.8% of the whole cohort (65.8% of those for whom addresses were available) conceals marked variations from school to school (see Table 1.1). The response rate also varied by sex (68.4% of girls compared to 47.9% of boys) and by educational attainment and home background. The characteristics of the respondents and non-respondents to the questionnaire are shown in Table 6.1. It is clear that the young people who replied immediately had done better, on average, in their O levels and CSE's than those who replied at a later stage. Those who did not reply at all, and those for whom no address was available (either because it was missing from school records, or because the letter was returned by the Post Office), had the least good educational qualifications. The pattern of scores on the Background Variable was similar to that on Examination Score. The young people who replied immediately were also much more likely to be in full-time study and slightly less likely to be neither working nor studying than those who replied at a later stage. No information is of course available on the current occupations of those who did not reply at all, but in the light of their poor qualifications it seems probable that they were less likely to be studying and more likely to be idle than those who did reply.

Table 6.1 The characteristics of respondents and non-respondents to the follow-up questionnaire

	mean score		% in full	% with no	N	
	EXAMTOT	BACKGR	time study	work or study	girls	boys
Immediate response	30.9	28.5	42.1	12.3	374	253
After reminder letter	27.5	25.9	30.1	12.5	74	62
After second questionnaire	23.2	24.4	21.7	19.4	133	128
No response	20.4	21.8	-	-	176	360
No address	19.7	22.4	-	-	90	121

These response biases render problematic the generalization of results for seventeen year olds from the questionnaire returns to the whole cohort. To compensate for the imbalances, weights were computed on the basis of sex and qualification, as shown in Table 6.2. The weights have been used throughout this chapter when results for the whole cohort are discussed (but not when responses at age seventeen are compared with responses given by the same people at an earlier age). The overall weight for each sex was 1.00, so as to keep the total number of girls and boys responding to the questionnaire the same in the weighted and unweighted analysis.

Table 6.2 Response rates and weights for each sex and achievement group

	girls			boys		
EXAMTOT	% response	N	weight	% response	N	weight
Over 50	94.2	52	0.73	90.8	25	0.53
40 - 49	89.2	111	0.77	70.5	105	0.68
30 - 39	76.8	164	0.89	69.2	156	0.69
20 - 29	75.3	178	0.91	51.4	173	0.93
10 - 19	65.3	118	1.05	46.4	153	1.03
0 - 9	63.0	108	1.09	34.9	149	1.37
no info	23.7	118	2.89	16.6	163	2.89
All	68.4	849	1.00	47.9	924	1.00

The current activities of the young people in the GIST cohort are shown in Table 6.3. On the weighted figures over half of these seventeen year olds had given up studying completely. The remainder were approximately evenly divided between A level and vocational study, with about 5% undertaking other non-vocational study such as repeating O levels or taking the Certificate of Extended Education (CEE). Two-thirds of the young people had some sort of paid work, and over 45% were in regular employment. Less than 10% were enrolled in Government schemes for the unemployed, and the remainder had 'pocket-money jobs' (such as a paper round or evening shelf-filling). When study and work were viewed in combination (Table 6.3(c)) it appeared that over a third of these seventeen year olds were in full-time work which did not include any training component, while nearly 20% had neither work nor study to keep them occupied. Among those who had no qualifications at age 16 this proportion rose to 45% (not shown).

The differences between action and control schools which were so marked in the background variables were also evident in the current activities of the young

Table 6.3 Current activities of young people in the GIST cohort

	unweighted		weighted	
	girls %	boys %	girls %	boys %
(a) Type of study				
A levels	24.6	25.2	19.8	17.2
Other non-vocational	6.8	4.7	6.7	4.0
Vocational	19.8	24.7	18.4	21.7
No study	48.8	45.5	55.1	57.1
(b) Type of work				
Regular employment	43.0	46.3	44.1	46.2
Government scheme	7.2	9.2	8.0	10.7
Pocket-money job	18.3	12.8	14.9	8.4
No work	31.4	31.9	33.2	34.5
(c) Combinations				
f-t study + p-t work	21.2	15.4	17.8	10.4
f-t study + no work	14.8	17.9	12.9	13.9
p-t study + f-t work	11.5	18.2	10.4	15.2
p-t study + p-t work	1.9	2.3	2.1	2.1
p-t study + no work	1.8	1.4	1.6	2.3
no study + f-t work	30.3	31.0	32.9	36.3
no study + p-t work	3.4	0.9	3.0	0.9
no study + no work	15.2	12.9	18.9	18.9
N	567	435	567	435

f-t full time; p-t part time

people. The total response rate was 66% for girls in action schools compared to 77% for girls in control schools; the corresponding figures for boys were 46% and 56%. The respondents from control schools came from more advantaged homes than the respondents from action schools, with average scores on the Background Variable of 30.6 and 26.1 respectively. They were also more academically successful (with higher Examination Scores), more likely to be studying full time (48% from control schools compared to 24% from action schools on the weighted figures) and less likely to be neither working nor studying (9% compared to 21%).

None of these factors were directly related to the GIST interventions, and these variations between action and control schools complicate the making of comparisons. If the School Handicap Score (which was designed to compensate for differences in school intakes and school effectiveness) is working as it should, the differences between action and control schools should disappear when HANDICAP is controlled. Table 6.4 shows that this does in fact happen. The eta

Table 6.4 Eta coefficients for the difference between action and control schools in the proportion of their former pupils taking A levels and having no employment or study.

	unweighted		weighted	
	girls	boys	girls	boys
Studying full time				
no covariates	-.18***	-.25***	-.18***	-.23***
covarying BACKGR	-.10**	-.18***	-.11**	-.18***
covarying HANDICAP	.02	-.08	.00	-.09
No employment or study				
no covariates	-.10*	-.13***	-.11**	-.13***
covarying BACKGR	-.05	-.10*	-.07	-.11
covarying HANDICAP	.03	-.04	.01	-.06

Positive coefficients indicate that young people from action schools were more likely to be taking A levels and less likely to have no employment or study than young people from control schools

* difference between action and control significant beyond the 5% level
** difference between action and control significant beyond the 1% level
*** difference between action and control significant beyond the 0.1% level

coefficients for the raw differences between action and control schools in the likelihood of studying full time and of having no employment or study were all highly significant; they were reduced, but by no means eliminated, by controlling for the Background Variable. However when the School Handicap Score was covaried the differences between action and control schools became small and insignificant. This is a reassuring result as it suggests that HANDICAP is effective in controlling for between-school variation which is unrelated to the GIST interventions. It makes little difference whether the weighted or unweighted data are used in this analysis, as the response biases were similar in action and control schools.

6.2 Career Plans

The postal questionnaire asked the seventeen year-olds 'What are your plans for the future?' 84% of those who answered this question did so in terms of jobs (although some did not name a particular job, saying, for example, that they wanted to get any job or get a good job). Where young people did mention a specific job in their future plans this was coded for scientific content in the way described in Section 5.1. The results are shown in Table 6.5. As in third year, boys were far more likely than girls to name a career with some scientific

Table 6.5 Percentage of girls and boys from action and control schools mentioning planned jobs with scientific or technical content

	Unweighted				Weighted			
	Girls		Boys		Girls		Boys	
Scientific content	Act	Cont	Act	Cont	Act	Cont	Act	Cont
none	72.8	78.6	54.5	54.9	75.1	78.3	57.3	56.7
same	20.2	15.7	12.4	7.8	19.3	16.6	13.6	9.5
a lot	7.0	5.7	33.2	37.3	5.6	5.0	29.0	33.8
N	243	70	202	51	250	58	215	39

or technical content. However comparison with Table 5.1 shows that both girls and boys were considerably less likely to name jobs with scientific content than they had been in third year. This is part of the process of redefinition of occupational aspirations as the world of work approaches (Kelly, 1988b).

Turning to differences between action and control schools, we see that the tendency for girls in action schools to expect more scientific jobs than girls in control schools has persisted from third year to age seventeen, although in a less marked form. The opposite tendency among boys, for those in control schools to expect more scientific jobs than those in action schools, has also persisted. These impressions are confirmed by the analysis of variance in Table 6.6 which shows eta coefficients of the same sign as, but slightly smaller magnitude than, the equivalent coefficients in Table 5.2. Although some of these coefficients are as large as those in earlier chapters, none of them are significant because of the reduced sample size at age seventeen.

Table 6.6 Eta coefficients for the size of the relationship between the scientific content of planned job and having being at an action or control school

	Unweighted		Weighted	
	Girls	Boys	Girls	Boys
Scientific content				
no covariates	.05	-.02	.03	-.02
covarying BACKGR	.09	-.01	.07	-.01
covarying HANDICAP	.12	.07	.10	.04

Positive coefficients indicate that children in action schools planned more scientific jobs than children in control schools.

6.3 Sex Roles in the Home

There is one other respect in which the outcomes of the GIST project in third year and at age seventeen can be directly compared. The questions about marital roles which were asked in first and third year were repeated on the postal questionnaire to seventeen year olds. The idea of being married with children of their own would not require such a leap of imagination for the teenagers as it had done at an earlier age; indeed for a few of them it was already a reality. (Although there was no question on this, twenty of the girls (3.5%) spontaneously mentioned that they either had a child or were pregnant). The replies are presented in Table 6.7, which also shows the replies given by the same children in third year. Both girls' and boys' ideas had changed dramatically over this three-and-a-half year period. At seventeen they were much more likely than at fourteen to think that women should be employed when their children were young, that men should help in the house even if the woman was at home all day, and that husband and wife should be equally clever. Sex differences in these attitudes, which were quite marked in third year, had almost disappeared by the time the young people reached seventeen.

The changes in attitudes to sex roles between first and third year were explored in Section 5.4. It was shown there that girls in action schools became

Table 6.7 Percentage of girls and boys from action and control schools agreeing with certain views of women's and men's roles in the home

	Girls				Boys			
	3rd year		Age 17		3rd year		Age 17	
	Act	Cont	Act	Cont	Act	Cont	Act	Cont
Women should work...	%	%	%	%	%	%	%	%
all the time	19.3	10.4	26.9	28.0	12.7	11.6	27.7	21.7
when kids at school	78.9	83.2	71.1	68.0	69.7	68.1	64.0	69.6
not at all	1.8	6.4	2.0	4.0	17.6	20.3	8.2	8.7
Men should help in house...								
even if wife at home	49.0	44.2	63.2	56.6	43.4	54.2	69.3	75.0
if wife goes to work	47.8	52.7	35.9	43.4	47.9	33.3	27.7	23.6
not at all	3.2	3.1	0.9	0.0	8.6	12.5	3.0	1.4
Spouse should be								
cleverer than self	25.1	36.0	15.9	23.2	10.9	4.3	14.3	15.9
about the same	73.1	63.2	82.9	76.0	76.6	79.7	82.3	78.3
less clever than self	1.8	0.8	1.2	0.8	12.5	15.9	3.4	5.8
N	345-334	129-125	345-334	129-125	267-265	72-69	267-265	72-69

slightly more committed to employment and slightly less likely to want a cleverer spouse than girls in control schools. The changes in attitude between first year and age seventeen are analysed in a similar way in Table 6.8. The eta coefficients are generally small, which suggests that being in an action school had little long-term effect on changes in pupils' attitudes to marital sex roles. The results are similar if the seventeen-year-old responses themselves (rather than the changes in responses) are analysed (not shown). As Table 6.7 demonstrated, the changes due to maturation were considerably larger than the differences between action and control schools. However girls from action schools were significantly more likely than girls from control schools to shift their views in the direction of demanding that their husbands should help in the house. They were also slightly more likely to become committed to employment, and slightly less likely to want a cleverer spouse. As in third year, the intervention effects, although small for both sexes, were more prominent for girls than for boys.

Table 6.8 Eta coefficients for the size of the relationship between changes in ideas about sex roles in the home between age eleven and seventeen, and having been at an action or control school

	wife's work		husband's help		spouse's ability	
	girls	boys	girls	boys	girls	boys
no covariates	.00	-.04	.10*	.01	-.04	-.01
covarying BACKGR	.03	-.03	.10*	.01	-.04	-.01
covarying HANDICAP	.09	-.01	.12*	.00	-.05	-.02

Positive coefficients indicate that young people from action schools were more likely than young people from control schools to say that (1) wives should work (2) husbands should help in the home (3) spouses should be cleverer.

* difference between action and control significant beyond the 5% level

6.4 Attitudes to Sex Roles and to Physics

The postal questionnaire contained sixteen items concerned with attitudes to sex roles and to physics. Young people were asked to respond to these on a five point scale, ranging from strongly agree (coded 5) to strongly disagree (coded 1). The mean responses to each item from girls and boys from action and control schools are shown in Table 6.9. Broadly speaking the responses were egalitarian, although this was more true for girls than for boys. The teenagers agreed with statements such as 'girls are just as good at physics as boys when they try' and 'men and women should take equal shares in looking after children';

Table 6.9 The mean responses of girls and boys from action and control schools to the attitude statements†

	Girls		Boys	
	Act	Cont	Act	Cont
1. Teachers pay more attention to boys than girls in physics	2.6 *	2.8	2.5	2.4
2. Its a bit odd if a man has a woman boss at work	1.8	1.7	2.3	2.2
3. Boys often grab all the equipment in physics lessons	3.0	3.0	3.2	2.9
4. Girls aren't encouraged to be interested in technical things	2.7**	3.1	2.8	3.1
5. Its not really a man's job to do cleaning and cooking	1.6	1.6	2.4	2.2
6. Girls are just as good at physics as boys when they try	4.4	4.4	4.1	4.2
7. Girls don't really need education as much as boys	1.4	1.4	1.7	1.7
8. Traditionally its mostly men who have studied physics, so girls just don't consider it	2.8	2.7	3.2	3.1
9. Men and women should take equal shares in looking after children	4.4	4.3	4.1	4.1
10. Physics is a difficult subject	3.5 *	3.8	3.8	3.8
11. People who have studied physics have a better chance of getting a job	2.4 *	2.2	2.6	2.6
12. Physics is more suitable for boys because its about things not people	2.1 *	1.9	2.2	2.1
13. Subjects like childcare and home economics are more important for girls than boys	2.0	2.1	2.8	2.7
14. Boys are just naturally better than girls at physics	1.8	1.6	2.2	1.9
15. The man should be the main breadwinner in the house	1.9 *	2.2	2.8	2.6
16. Physics isn't useful for the sorts of jobs girls do	2.0	1.9	2.5	2.3
N	452-445	126-123	356-348	66-64

* Difference between action and control significant beyond the 5% level
** Difference between action and control significant beyond the 1% level

† Weighted data

they disagreed with statements like 'girls don't really need education as much as boys'. There was little difference in the responses of young people from action and control schools, although action-girls were slightly less likely than control-girls to agree that 'teachers pay more attention to boys than girls in physics lessons', that 'girls aren't encouraged to be interested in technical things' that 'physics is a difficult subject' and that 'the man should be the main breadwinner in the house'; they were slightly more likely to agree that

'people who have studied physics have a better chance of getting a job' and that 'physics is more suitable for boys because its about things not people'. All of these differences, with the exception of the last, reflect positions that the GIST project attempted to foster. It is particularly encouraging that action-girls perceived less favouritism of boys and more encouragement of girls' technical interests than control-girls, as this suggests that teachers in the action schools were successful in changing their behaviour. Once again boys' attitudes differed less between action and control schools than girls'.

To study the underlying structure of young people's attitudes to sex roles and to physics the individual items can be grouped into scales. Factor analysis revealed three dimensions of attitude, which were labelled SEXROLE, PHYSROLE and PHYSLESS respectively. The items contributing to each scale and the scale characteristics are shown in Table 6.10. SEXROLE concerned attitudes to sex roles in general; PHYSROLE tapped teenagers' attitudes to the appropriateness of physics for girls and boys while PHYSLESS measured perceptions of differentiation between the sexes in physics lessons. PHYSROLE and PHYSLESS contained only three items each, and their reliabilities (as measured by Cronbach's alpha) were low; SEXROLE was longer, with six items, and its reliability was higher (although still not high).

Table 6.10 also shows the mean scores on each of these scales for girls and boys from action and control schools. There was little difference between the weighted and unweighted data on these variables, but for consistency weighted data are used throughout. Overall, girls were markedly less likely than boys to

Table 6.10 The characteristics of the attitude scales†

Scale	Items included in scale	Reliability Cronbach's α	mean scores Girls Act	Girls Cont	Boys Act	Boys Cont
SEXROLE	2,5,7,9 ,13,15	.71	1.7	1.8	2.3	2.2
PHYSROLE	6 ,12,14	.53	1.8	* 1.7	2.1	2.0
PHYSLESS	1,3,4	.57	2.8	** 3.0	2.8	2.8
N			446-444	126-123	351-346	66-65

* Difference between action and control significant beyond the 5% level
** Difference between action and control significant beyond the 1% level

† Weighted data - Item reversed before inclusion in scale

Table 6.11 Correlations between background factors and attitudes to sex roles and physics for girls and boys†

	Girls		Boys	
	BACKGR	HANDICAP	BACKGR	HANDICAP
SEXROLE	-.31***	-.24***	-.07	-.07
PHYSROLE	-.30***	-.27***	-.22***	-.21***
PHYSLESS	-.08*	-.05	-.14**	-.18***

* Correlation significant beyond 5% level
** Correlation significant beyond 1% level
*** Correlation significant beyond 0.1% level

† Weighted data

endorse gender differences in general or in physics. The sexes were more similar in the extent to which they perceived sex differentiation to take place in physics lessons. Young people from action and control schools were generally similar in their attitudes, although girls from action schools were slightly more likely than girls from control schools to think that physics was more suitable for boys than for girls, and slightly less likely to report male domination in their lessons.

As usual these comparisons are complicated by differences between the intakes and effectiveness of action and control schools. All three scales were negatively correlated with the social background variables BACKGR and HANDICAP for both girls and boys (Table 6.11). However it is noticeable that the correlations between social background and SEXROLE were much smaller for boys than for girls; conversely, background factors were less strongly related to PHYSLESS for girls than for boys.

The differences in attitude between young people from action and control schools, after allowing for social background, is shown in Table 6.12. For boys there were no significant differences on any of the scales. However girls from action schools were considerably less likely than comparable girls from control schools to endorse sex differences in general. There were no differences between girls from action and control schools in the extent to which they saw physics as more suitable for boys than for girls, but girls from action schools were less likely than girls from control schools to perceive male domination of physics lessons. These results indicate that the GIST project has had some long-term effect, albeit slight, on girls' attitudes.

Table 6.12 Eta coefficients for the relationship between attitudes towards sex roles and physics and having been in an action or control school for girls and boys†

	SEXROLE		PHYSROLE		PHYSLESS	
	Girls	Boys	Girls	Boys	Girls	Boys
no covariates	.04	-.06	-.09*	-.07	.09*	-.02
covarying BACKGR	.09*	-.05	-.04	-.04	.10*	.00
covarying HANDICAP	.16***	-.04	.03	.01	.13**	.06

Positive coefficients mean that young people from action schools are less likely than young people from control schools to (1) endorse differential sex roles in general (2) see physics as more appropriate for boys than for girls (3) perceive male domination in physics lessons

* Difference between action and control significant beyond the 5% level
** Difference between action and control significant beyond the 1% level
*** Difference between action and control significant beyond the 0.1% level

† Weighted data

7. Individual Schools

7.1 School Effectiveness

Schools differ. They differ in the way they are organised, they differ in the subjects they stress, and they differ in the philosophy they embody. These differences manifest themselves in different outcomes. Some schools achieve excellent examination results; others - or perhaps the same ones - produce pupils with positive self-images or well-developed social consciences. Such differences have been codified by Rutter et al (1979) in the word 'ethos'. In this Chapter I want to consider the variation between the ten schools we studied in the extent to which they embodied the GIST ethos.

The variation between schools in their intakes was considered in Section 1.2, and is measured by the Background Variable, BACKGR. Many of the outcome measures are correlated with BACKGR, and it is clearly unrealistic to expect schools with very different intakes to produce equivalent results. To allow for differences in intakes, all results in this Chapter are adjusted for differences in the Background Variable. They are presented as deviations from the results expected on the basis of mean BACKGR scores in each school, expressed as percentages of a standard deviation. This standardized measure enables school achievement on different outcomes to be compared directly. The extent to which variation occurs between schools, rather than within schools, is measured by eta.

Section 1.2 showed that, even after allowing for social background, some schools produced much better Examination Scores than others at 16+. These differences in overall school effectiveness are shown for girls and boys separately in Table 7.1. There are several points to be made from this Table, which also includes information on the Local Education Authorities and on girls' and boys' scores on the Background Variable.

First, it is clear that schools that produced good results among girls generally also produced good results among boys, and vice versa. Suttonhill, and to a lesser extent Hamlet and Green Park, were relatively less successful with girls than with boys, but the rank ordering of the schools was the same for both sexes.

Table 7.1 Over- or under-achievement of girls and boys at each school compared to the Examination Scores expected on the basis of the Background Variable, together with the LEA and the average BACKGR score at each school

	EXAMTOT		LEA	BACKGR	
	Girls	Boys		Girls	Boys
Action Schools					
Ashgrove	-49	-45	A	-33	-21
Edgehill	23	18	B	58	41
Green Park	-20	2	C	-44	-69
Hamlet	-77	-55	A	0	12
Meadow Vale	-7	4	B	-14	-4
Moss Green	-59	-64	A	-47	-67
Suttonhill	-49	-14	A	-27	5
Tall Trees	22	6	C	-8	3
Control Schools					
Burnbank	-22	-5	C	-85	-81
New Hall	86	81	B	74	68
eta	.33***	.30***		.48***	.44***

EXAMTOT scores are expressed as a percentage of a standard deviation above or below the prediced value for each school; BACKGR scores are expressed as a percentage of a standard deviation above or below the mean.

*** differences between schools significant beyond the 0.1% level

The second point concerns differences between Local Education Authorities (LEA's). Schools from three LEA's were involved in the GIST project, and these are indicated in Table 7.1. Children from all four schools in Local Authority A achieved worse Examination Scores than would have been predicted from the Background Variable. This LEA was completely re-organised as the GIST cohort entered their third year of secondary schooling. All the teachers had to re-apply for their jobs, and many ended up in different schools. It seems likely that the poor results achieved by these schools is related to the disruption they suffered during re-organisation. Schools in Local Authority B generally achieved slightly better results than would have been expected on the basis of their intake, while the results in Local Authority C were broadly in line with those predicted from pupils' backgrounds. Hierarchical models are required for a proper analysis of LEA effects, and that will not be attempted here. However the results do provide *prima facia* evidence that Local Authority management practices in education have distinctive results.

Another feature of Table 7.1 can be seen by comparing the average scores on the Background Variable with the measures of over- or under-achievement on Examination Score. By and large, pupils in schools with above-average BACKGR scores, indicating that most pupils had advantaged backgrounds, did even better than would have been expected on the basis of their own, individual, home backgrounds. Thus pupils at New Hall and Edgehill, the two schools with the highest average BACKGR scores, achieved even better than expected in external examinations. Conversely pupils at Moss Green and Ashgrove had poor home backgrounds and achieved even worse than predicted in examinations. This 'to them that hath shall be given' relationship was not an inevitable rule: pupils at Hamlet achieved poorly in external examinations, despite their average backgrounds; pupils at Green Park and Burnbank had very disadvanted backgrounds, but their achievements were only slightly below expectation. But there was a tendency for individual pupils' achievement to be linked not only to their own background, but also to the background of their peers. This 'ecological' effect is similar to the positive effect of having 'affluent classmates' observed in the United States in the 1960's (Coleman et al, 1966; Jencks et al, 1972).

Table 7.2 Over- or under-involvement in post-sixteen study of young people from each school†

	Girls			Boys		
	f-t study	A levels	some study or work	f-t study	A levels	some study or work
Action Schools						
Ashgrove	9	10	8	5	0	-3
Edgehill	15	12	3	0	-3	25
Green Park	-19	-17	-59	-32	-19	-13
Hamlet	22	2	-3	-5	-8	-13
Meadow Vale	-19	-15	18	-5	11	8
Moss Green	-15	-2	-43	30	5	-15
Suttonhill	-28	-22	-8	-30	-27	-23
Tall Trees	6	7	20	0	-13	-25
Control Schools						
Burnbank	-4	10	-5	7	24	28
New Hall	30	30	20	58	45	25
eta	.21**	.18**	.24***	.25***	.21**	.20

Results are expressed as a percentage of a standard deviation above or below the values predicted by the Background Variable.

† Weighted data
** differences between schools significant beyond the 1% level
*** differences between schools significant beyond the 0.1% level

The effectiveness of individual schools is explored further in Table 7.2, which presents the post-sixteen destinations of children from each school. Again there are significant variations from school to school, even after allowance had been made for the Background Variable. These variations were not as large as the variations in examination results, nor were they as consistent. Young people from New Hall were more likely to be in full-time study, more likely to be doing A levels, and less likely to be doing nothing than would be expected on the basis of their individual home backgrounds; the reverse was true for young people from Green Park and Suttonhill. All the other schools had a mixture of better-than-expected and worse-than-expected post-sixteen outcomes. However there was still a tendency for young people from schools where most of the pupils came from favourable home backgrounds to do better than would be expected on the basis of their individual characteristics, and vice-versa for schools in disadvantaged areas.

7.2 Option Choices

Turning from these general differences between schools, I will now examine the differences on outcome measures directly related to the GIST project. The uptake of physical science and technical craft in individual schools is explored in Table 7.3. The variation between schools was greater than would be expected by chance, after allowing for differences attributable to initial intake, in all subjects. However it was noticeably greater for boys' uptake of physics and technical craft, than for other subjects. This suggests that these two subject areas were particularly susceptible to alterations in school policy and ethos.

There is little evidence of across-the-board school effects in Table 7.3. Different schools were successful in different areas. Some subjects were more popular than expected with both girls and boys in a school, but other subjects appealed to one sex only. Meadow Vale and Edgehill were the schools which were most successful in encouraging girls to take physics when it became optional. Both of these schools also had greater-than-predicted numbers of boys taking physics. Physics was unpopular with both sexes at Green Park, Hamlet and Suttonhill. However boys were well represented in physics at Ashgrove and Burnbank, without any corresponding rise in girls' enrolments. One of the control schools, Burnbank, had outstanding enrolments of girls in chemistry, but otherwise the figures for chemistry were similar

Table 7.3 Over- or under- enrolment of girls and boys in physics, chemistry and technical crafts at each school

	Girls			Boys		
	Physics	Chem	Tech Craft	Physics	Chem	Tech Craft
Action Schools						
Ashgrove	-8	0	9	56	2	6
Edgehill	21	5	3	15	12	-20
Green Park	-27	-7	19	-53	-24	63
Hamlet	-38	16	-12	-41	12	87
Meadow Vale	30	-7	6	41	-10	-26
Moss Green	-11	5	41	-27	31	-9
Suttonhill	-32	2	-19	-51	-29	-10
Tall Trees	0	-7	9	-19	2	-17
Control Schools						
Burnbank	5	90	-12	60	7	13
New Hall	16	-24	-22	24	21	-54
eta	.21***	.22***	.17**	.34***	.16**	.37***

Results are expressed as a percentage of a standard deviation above or below the values predicted by the Background Variable.

** differences between schools significant beyond the 1% level
*** differences between schools significant beyond the 0.1% level

to the predicted values. Large numbers of boys took technical crafts at Hamlet and Green Park, while such subjects were under-represented in boys' curriculum at New Hall. Moss Green was the only school which had substantially more girls than expected taking technical crafts.

These results suggest that GIST may have had an effect on particular subject areas - such as physics at Meadow Vale and Edgehill or technical crafts at Moss Green - rather than across the school as a whole. In fact in all of these cases it is possible to think of particular teachers who were actively involved in the project (see Whyte, 1986). Although such an analysis is entirely *post hoc* it suggests that individual involvement may have effects on pupil choice even when the rest of the school is not fully involved.

7.3 Attitudes to Science

As with option choices, there were significant differences between schools in the way attitudes to science changed over the three years of the GIST project. These are explored in Table 7.4, which shows where attitude changes

Table 7.4 Above or below average changes in attitudes to science at each school

	PHYSCUR	NATSTCUR	HUMBICUR	TVSCICUR	SCIWORLD	LIKESCI	SCIENT	SCIMALE§
Girls								
Action Schools								
Ashgrove	-19	-36	-32	-23	-8	-22	5	-24
Edgehill	45	20	18	26	30	18	42	28
Green Park	0	27	25	2	15	31	12	-8
Hamlet	-19	-9	27	12	-40	-22	-47	-4
Meadow Vale	-5	5	2	12	5	7	23	36
Moss Green	29	36	18	39	35	53	79	52
Suttonhill	-14	-20	-27	-37	-30	-4	-33	-12
Tall Trees	10	-11	7	5	35	9	-12	4
Control Schools								
Burnbank	-12	-34	-2	-12	-8	-4	-2	-20
New Hall	-19	-2	-20	-12	-28	-29	-42	-40
eta	.19***	.16**	.16**	.17*	.21***	.19***	.28***	.21***
Boys								
Action Schools								
Ashgrove	-2	-11	8	2	5	-31	-10	-5
Edgehill	37	34	29	29	41	24	46	49
Green Park	15	-4	-18	0	-2	2	-19	-40
Hamlet	12	15	27	22	2	22	10	12
Meadow Vale	-7	-13	2	2	-5	0	2	9
Moss Green	-20	19	-16	-36	-9	14	10	23
Suttonhill	-15	-21	-37	-13	-44	-14	-25	-26
Tall Trees	-2	19	0	13	7	2	-15	-21
Control Schools								
Burnbank	7	-29	4	-25	21	24	10	2
New Hall	-25	-6	-14	-16	-16	-29	-23	-23
eta	.17**	.16*	.17**	.16*	.19***	.16**	.18***	.20***

Results are expressed as a percentage of a standard deviation above or below the values predicted by the initial scores and Background Variable.

Positive scores indicate above average increases (or below average decreases) in attitudes between first and third year.
§ scores reversed so that positive changes indicate an improvement in attitudes (i.e. science less likely to be seen as masculine).

* differences between schools significant beyond the 5% level
** differences between schools significant beyond the 1% level
*** differences between schools significant beyond the 0.1% level

were better or worse than those expected on the basis of initial attitudes and home background.

Edgehill stands out in this analysis. All the attitude changes at Edgehill, for both girls and boys, were more positive than would have been predicted on the basis of the children's original scores. Girls' attitude changes were

also consistently more positive than expected at Moss Green, and to a lesser extent at Green Park, Meadow Vale and Tall Trees. At these five action schools the GIST project seems to have created a consistent pro-science ethos among girls. Referring back to Table 7.3 shows that, by and large, these were also the schools where more girls than expected enrolled in physics and/or technical crafts. At the two control schools, New Hall and Burnbank, girls' attitude changes were consistently worse than predicted, and this was also true at Suttonhill and to a lesser extent at Ashgrove and Hamlet.

Boys' attitudes also changed in a positive direction at Edgehill and in a negative direction at New Hall and Suttonhill. These results suggest that at these three schools there was a general pro- or anti-science ethos, affecting both girls and boys. At other schools the ethos was confined to one sex. Boys at Hamlet had consistently positive attitude changes, despite the generally negative changes in girls' scores. At Ashgrove, Green Park, Moss Green, Tall Trees and Burnbank boys' attitude changes were sometimes positive and sometimes negative.

The variation between schools was considerably greater for girls' image of a scientist than for the other scales. At two of the action schools, Moss Green and Edgehill, girls' image of a scientist improved much more than would have been expected on the basis of initial characteristics. At two other action schools, Hamlet and Suttonhill, and at the control school New Hall, girls' image of a scientist deteriorated sharply. This is the attitude scale which was most directly linked to the intervention of taking women scientists into schools, and the results suggest that this strategy was much more successful at some schools than at others - possibly depending on the pre-existing school ethos.

7.4 Sex Stereotyping

Changes in sex stereotyping at different schools can be explored in the same way as changes in attitudes to science. This is done in Table 7.5, which shows the mean change in each stereotyping measure at each school, after allowing for differences in intake. The eta values show that there was no significant variation between schools in the way that attitudes to traditionally masculine pursuits changed among either girls or boys. On the

Table 7.5 Above or below average changes in sex stereotyping at each school

	SEXTYPE		FSELF		MSELF	
	Girls	Boys	Girls	Boys	Girls	Boys
Action Schools						
Ashgrove	43	34	17	40	27	-2
Edgehill	-27	28	-8	-13	-16	-17
Green Park	23	-8	55	13	6	-14
Hamlet	-29	8	0	-27	4	-11
Meadow Vale	41	-6	-17	20	0	0
Moss Green	-2	10	41	2	29	29
Suttonhill	-2	-15	27	-4	12	5
Tall Trees	23	2	-25	16	6	25
Control Schools						
Burnbank	4	6	25	-13	-14	14
New Hall	-37	-34	17	-24	-12	-5
eta	.22###	.16###	.20###	.16##	.11	.11

Results are expressed as a percentage of a standard deviation above or below the values predicted by the initial scores and Background Variable.

Positive scores indicate that sex-typing decreased more than expected or that interest in feminine or masculine jobs for self increased more than expected between first and third year.

differences between schools significant beyond the 1% level
differences between schools significant beyond the 0.1% level

other two scales (sex-typing and attitudes to traditionally female pursuits) there was more variation between schools in the way girls' attitudes changed than in the way boys' attitudes changed.

For both sexes the largest unexpected reductions in sex-typing were found at Ashgrove and the smallest reductions at the control school, New Hall. Apart from this, and an unexpected reduction at Edgehill, boys' sex-typing was more or less as predicted. Girls' sex-typing reduced substantially more than expected at Meadow Vale, Green Park and Tall Trees, but less than expected at Edgehill and Hamlet. Although no detailed comparison of the quantitative and qualitative evidence has been attempted, these variations between schools probably reflect the different interventions used, with differing degrees of enthusiasm, at different institutions. Further discussion of the interventions and response at each school can be found in the book on the GIST project (Whyte, 1986).

7.5 Age Seventeen

The variations between schools in GIST-related outcomes at age seventeen are explored in Table 7.6. This shows above or below average attitudes to sex roles and to physics, and above or below average scientific content of the jobs the young people from each school aspire to, after allowing for the Background Variable. Because of the reduced numbers of respondents at this age, many of the variations between schools are not significant, even when they are as large as those in previous Tables. Nevertheless Table 7.6 shows some consistent patterns. Both girls and boys from Egdehill scored better than predicted on all the measures taken from the postal questionnaire. The same was true for girls at Moss Green. On the other hand young people from Green Park, scored consistently worse than predicted. Results at other schools were more mixed, with the greatest variation between schools occuring in boys' hopes for scientific jobs.

Table 7.6 Above or below average attitudes to gender roles, to physics and to scientific jobs among young people from each school. †

	SEXROLE		PHYSROLE		PHYSLESS		scientific content of desired job	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Action Schools								
Ashgrove	27	-7	21	-8	2	-14	-19	-26
Edgehill	2	15	11	10	32	35	16	48
Green Park	-14	-25	-50	-21	-31	-28	-26	-10
Hamlet	18	12	-3	-21	-2	-17	44	34
Meadow Vale	7	-18	-13	-6	-9	-3	7	-28
Moss Green	2	-3	36	39	13	-29	44	-36
Suttonhill	14	7	14	0	-14	-18	-12	-31
Tall Trees	-7	11	16	8	44	51	-5	3
Control Schools								
Burnbank	4	35	17	28	21	-15	-25	-41
New Hall	-23	1	5	-1	-31	9	-11	26
eta	.15	.15	.21***	.15	.26***	.21***	.20	.32***

Results are expressed as a percentage of a standard deviation above or below the values predicted by the Background Variable.

Positive scores indicate that ideas about sex roles and the appropriateness of physics for girls and boys were less stereotyped, that physics lessons were reported as being less dominated by boys, and that more scientific occupations were planned than expected on the basis of home background.

† Weighted data
** differences between schools significant beyond the 1% level
*** differences between schools significant beyond the 0.1% level

8. Summary and Conclusions

8.1 Summary

The GIST project was designed on a quasi-experimental format. There were eight action schools and two control schools. Unfortunately the children attending action and control schools came from substantially different types of home background. The children from control schools were, on average, much more advantaged than the children from action schools. The control schools also appeared to be somewhat more effective in developing the academic potential of their children. These differences between action and control schools meant that it was impossible to compare results directly. Variations in home background and school effectiveness always had to be taken into account.

The analysis of option choices in Chapter 2 showed that the interventions had only limited impact on pupils' decisions to continue with or drop physical science and technical craft subjects. When all the relevant background factors had been taken into account, action-girls were slightly more likely than control-girls to continue with technical crafts. There were no significant differences between action and control schools in the overall proportion of girls continuing physics or chemistry into fourth year. However when the analysis was performed separately on different groups of children it appeared that middle class and/or more able girls in action schools were more likely to continue with physical science than comparable girls in control schools. This suggests that the interventions were most effective with girls who already had the personal resources to enable them to take advantage of the opportunities being offered. Neither attitudes to science nor attitudes to sex roles on entry to secondary school seemed to predispose girls to respond either positively or negatively to the ideas being put forward by GIST. Boys' option choices varied less than girls' between action and control schools, although there was again a slight tendency for middle class pupils to be more likely to continue physical science in action than in control schools.

The differences between pupils from action and control schools were more marked on attitudes to science than on subject choice (Chapter 3). Attitudes to science generally declined between the first and third year of secondary school. This was particularly true for general liking for science among

girls. It did not hold for interest in learning about human biology, or for seeing science as a masculine subject; on both of these dimensions attitudes improved. There was a small but consistent tendency for attitudes to decline less in action schools than in control schools, and this was more pronounced among girls than among boys. This suggests that GIST was effective in limiting the decline in children's attitudes to science. When particular groups of children were considered, the interventions seemed to be most influential among those from middle class backgrounds. Boys with high general ability benefited more than boys of lower ability, but this factor made little difference to girls. Pupils' initial attitudes to science did not appear to influence their response to the GIST interventions.

During the course of the project girls in action schools became much more willing than girls in control schools to say that it was acceptable for girls to become electricians, car mechanics and engineers (Chapter 4). They also became markedly less sex-stereotyped in general, and somewhat more willing to consider traditionally masculine jobs for themselves. Boys in action schools also became less sex stereotyped than their peers in control schools, but they did not vary in their (un)willingness to consider traditionally female jobs for themselves. Once again it was middle class and/or more able girls who appeared to benefit most from exposure to the GIST interventions. These pupils seemed to be more able to take advantage of new ideas than less favoured pupils. And once again initial views did not predispose pupils to respond either positively or negatively to GIST inputs.

There were some differences between children in action and control schools in their ideas about the future (Chapter 5). Boys were much more likely than girls to expect a job with some scientific or technical content, but action girls were slightly more likely to expect such jobs than control girls. Action girls, and to a lesser extent boys, also had more favourable opinions about the jobs of scientist and engineer, on a range of dimensions. Turning to think about school subjects, boys were much more likely than girls to consider physical science and technical craft subjects vocationally useful. There were no differences between children from action and control schools in this respect. However children from action schools were much less likely to perceive sex differences in achievement in craft subjects, and were more likely to say that girls and boys were equally good at all subjects at school. Action girls were somewhat more career orientated than control

girls, being slightly more likely to want to work when they had young children, and slightly less likely to want to give up work permanently when they became mothers. They were also slightly less likely to want to marry a man who was cleverer than themselves.

A postal questionnaire was sent to members of the GIST cohort a year after they reached the statutory school leaving age. It was returned by 57.8% of the young people, and these were disproportionately the more academically successful teenagers from more advantaged homes (Chapter 6). As in first and third year, the background characteristics of respondents from control schools were markedly different from those in action schools. When differences in school intake and effectiveness were controlled there were some indications that GIST had had a lasting effect. Girls from action schools planned somewhat more scientific careers than girls from control schools. Action-girls were also slightly more likely than control-girls to demand that their future husbands should help around the house. These differences between action and control girls in job plans and marital roles were similar to, but less marked than, the equivalent differences in third year. Action girls were significantly more egalitarian than control girls in their general ideas about gender roles. They were also less likely to report that their physics lessons had been dominated by boys, which suggests that their teachers had successfully modified their classroom management techniques. There were no marked or significant differences between boys from action and control schools at age seventeen. This too repeats the pattern found in the earlier data, for the GIST interventions to have had more effect on girls' attitudes than on boys'.

There were a large number of significant between-school variations in outcomes, even allowing for differences in school intakes (Chapter 7). Some schools were more effective than others in achieving the various aims of the GIST project. Meadow Vale and Edgehill were the most successful schools in getting more girls than expected to enrol in physics, while Moss Green and Green Park had the greatest over-enrolments in technical crafts. These four schools also produced the most positive changes in attitudes to science over the three years that GIST was working in the schools. This patterning suggests that GIST may have contributed to a general change of atmosphere towards girls in the science or technical departments of these schools. However this did not necessarily spill over to a general reduction of sex-

typing or interest in cross-sexed activities: here Ashgrove was the most successful school. Nor did it necessarily persist to age seventeen. Although Edgehill and Moss Green were still successful schools (in GIST terms) by this stage, Meadow Vale was only average, and Green Park was poor. At the other end of the scale pupils at Suttonhill and Hamlet performed less well than expected on enrolments, attitudes and sex-typing in third year. The same was true, on all measures except enrolments in physics, for the control school New Hall. However by age seventeen both girls and boys at Hamlet were showing greater-than-expected interest in scientific jobs, and slightly less-than-expected sex role stereotyping. The other schools where pupils performed poorly in third year were all around average by age seventeen. Once again, it is difficult to identify consistent effects in any particular schools.

8.2 Overview

This quantitative analysis of the data from the GIST project has confirmed many of the trends which were evident in the preliminary analyses. It has also revealed many features which were not apparent in those earlier, less detailed, explorations. By combining data from the different surveys, and by following the young people involved in the project beyond the end of compulsory schooling, it has proved possible to get a fuller picture than before of the impact of the GIST interventions on their subject choices, attitudes and aspirations.

One of the most striking results is that, in general, GIST had more effect on children's attitudes and beliefs than on their actions. Pupils in action schools were much more egalitarian than pupils in control schools in their ideas about what were appropriate jobs for girls and boys, and what school subjects girls and boys were better at. They were slightly more likely to want a scientific job for themselves, and to have positive changes in their attitudes towards science. However there was very little difference between action and control school pupils in their choice of scientific and technical subjects to study in fourth year.

Vocational usefulness and liking for the subject are two factors that most pupils identify as influencing their subject choice (Kelly, 1988a). There were no significant differences between pupils from action and control

schools in the extent to which they saw scientific and technical subjects as vocationally useful, and only small differences in their liking for science. It may be that any future project which aims to alter option choices should concentrate on these two areas. A reduction in sex stereotyping, although certainly desirable, does not seem to have direct consequences for subject choice, and may not have consequences in the world outside school. It is difficult to put egalitarian principles into practice if girls continue to lack the qualifications which would permit them to enter areas traditionally reserved for men. Tackling this problem via destereotyping exercises may be ineffective not because such exercises do not work, but because they ignore the context within which choice operates. Pupils perceive their options as manifestations of their individual orientations, not as expressions of sex stereotyping. A change in individual orientation does not necessarily or directly affect the structural constraints within which young people's lives are lived.

Some teachers and commentators have suggested that projects such as GIST, which focus on girls and their needs, may disadvantage boys. There is no evidence in this report to support such a contention. In fact there is little evidence of **any** effect on boys. Most of the differences between action and control girls were larger for girls than for boys; boys seemed to be largely untouched by the project. This is despite the fact that nearly all interventions were carried out in mixed groups. The classroom exercises on sex-stereotyping were aimed at least as much at boys as at girls but, like other interventions, they produced larger changes in girls' attitudes than in boys'. Again this is something which any new project should take into account. Boys provide the context within which girls operate, and it is important to consider their attitudes and expectations when trying to bring about change in girls' life-chances.

The group which seemed to benefit most from the GIST interventions was middle class and/or high ability girls. Such girls were more likely to choose physical science at an action school than at a control school, and had more positive attitude changes towards science and towards sex stereotypes. Their home background appeared to provide these girls with the personal resources which allowed them to take advantage of unconventional ideas. On the other hand pupils' initial attitudes were generally unrelated to their reaction to being in an action school. Children seemed to respond equally to

the GIST project whether they were interested in science in first year or not; and their reactions were similar whatever their initial views on sex roles.

By and large it did not prove possible to identify schools which were successful or unsuccessful in implementing the GIST project. Different schools were effective in different areas. As I have argued elsewhere (Kelly, 1986) there may be particular difficulties in institutionalizing a project such as GIST which contains implicit criticisms of teachers, both professional and personal. So it is not altogether surprising that the effects were erratic and idiosyncratic. Ripple effects, whereby other teachers in other schools are inspired to try interventions which fit their own situation and predisposition, may be the most effective legacy of the GIST project.

The GIST cohort were followed from the age of eleven, when they entered secondary school, to the age of seventeen, one year after the statutory school leaving age. Seventeen is in many ways an unfortunate age at which to end the study; the young people are in the midst of the transition from childhood to adult status, from school to employment or unemployment, from living with their parents to establishing their own homes. It is too early to say what effect, if any, the project will have on their long term futures. However it is encouraging to find that three and a half years after the project team stopped work in schools the pupils in action schools were still more interested in scientific careers and less sex-stereotyped than their counterparts in control schools.

In some instances - attitudes to science, to sex stereotypes and to marital roles - maturation produced larger effects than being in an action or control school. On average all pupils became less interested in science and more egalitarian in their attitudes as they grew older. This being so it has to be asked whether intervention in school is appropriate, or whether the resources could be more effectively employed at some other stage. I think the answer is that this is in many ways a false choice. Work on expanding horizons can and should take place at all ages and stages. But some stages are more crucial than other simply because they produce constraints which limit future options. With the present system of subject choices at age fourteen, the first three years of secondary schooling are such a stage.

References

Bourdieu P. (1977) 'Cultural reproduction and social reproduction' in Karabel J. & Halsey A.H.(eds) Power and Ideology in Education Oxford University Press.

Coleman J.S. *et al* (1966) Equality of Educational Opportunity Government Printing Office, Washington D.C.

Jencks C. *et al* (1972) Inequality Basic Books.

Kelly A. (1986) 'Changing schools and changing society' in Arnot M. (ed) Race and Gender: Equal Opportunities Policies for Education Open University Press.

Kelly A. (1988a) 'Option choice for girls and boys' Research in Science and Technological Education Vol 6, pp 5-23.

Kelly A. (1988b) 'When I grow up I want to be .... A longitudinal study of the development of job preferences among girls and boys' British Journal of Guidance and Counselling

Kelly A. & Smail B. (1986) 'Sex stereotypes and attitudes to science among eleven-year-old children' British Journal of Educational Psychology Vol 56, pp 158-168.

Kelly A., Whyte J. & Smail B. (1984) Girls Into Science and Technology: Final Report Department of Sociology, University of Manchester. ERIC Document ED 250 203. Part reprinted in Kelly A. (ed) Science for Girls Open University Press, 1987.

Payne G., Hustler D. & Cuff T. GIST or PIST: Teachers' Perceptions of the Project Girls Into Science and Technology Manchester Polytechnic, 1984.

Reynolds D. (1985) Studying School Effectiveness Falmer Press

Rutter M. et al (1979) Fifteen Thousand Hours Open Books.

Smail B. & Kelly A. (1984) 'Sex differences in science and technology among eleven year old children: II Affective' Research in Science and Technology Education Vol 2, pp 87-106

Whyte J. (1986) Girls Into Science and Technology: The Story of a Project Routledge & Kegan Paul.

Appendix A

Annotated Bibliography of Publications from the Girls Into Science and Technology (GIST) Project

A large number of publications have resulted from the GIST project. These are listed below so that interested readers can explore the project further. Publications are numbered in order of writing (which does not always correspond to order of publication) and grouped according to subject.

Main Publications

30. Alison Kelly, Judith Whyte and Barbara Smail Girls Into Science and Technology: Final Report Department of Sociology, University of Manchester, May 1984. ERIC Document ED 250 203. 45pp. Part reprinted in Kelly A. (ed) Science for Girls Open University Press, 1987.

This Final Report for sponsors of the Girls Into Science and Technology project describes the conduct of the research and the interventions that were undertaken in schools. It also gives the main results, both quantitative and qualitative, of the project.

31. Barbara Smail Girl-Friendly Science: Avoiding Sex Bias in the Curriculum Schools Council/Longman, 1984. £3.25 pp83. Part reprinted in Kelly A. (ed) Science for Girls Open University Press, 1987.

Analyses the reasons that girls tend to drop science in Britain, and suggests ways of reducing sex bias in the curriculum, in written materials and in classroom/laboratory organisation. Contains appendices with examples of non sexist worksheets, details of women scientists and drawings which may be reproduced of girls performing standard laboratory operations.

38. Jonn Catton Ways and Means: The Craft, Design and Technology Education of Girls Schools Council/Longman, 1985. £3.25 pp68.

This sourcebook discusses the importance of Craft, Design Technology in the education of all pupils, including girls. It then describes ways in which the subject can be made more appealing to girls, based on the author's experience as a CDT teacher who succeeded in attracting a considerable number of girls into the subject, and his work on the GIST project.

45. Judith Whyte Girls Into Science and Technology: The Story of a Project Routledge & Kegan Paul, 1986. £16.95 pp250.

Descriptive account of the GIST project, 1979-84. Highlights the world of the typical school science lab and craft workshop; reveals how girls and boys viewed science and sex roles and how their attitudes changed during the course of the project. The GIST team worked with science and craft teachers to alter school factors which discourage girls from continuing with scientific and technical subjects. The book describes the reactions of teachers and pupils to intervention strategies, which included visits to schools by women working in technical jobs, development of teaching material redressing the balance to include girls' interests and a humanistic view of science, observations in school labs and workshops and careers education linked to option choices in school. Final chapters spell out the lessons to be learned for teachers and those engaged in training and evaluating the national impact of the GIST project.

61. Alison Kelly Getting the GIST: a Quantitative Analysis of the Effects of the Girls Into Science and Technology Project Occasional Paper, Department of Sociology, University of Manchester

A detailed statistical analysis of the data from the GIST project, including the results of a follow up study when the young people were seventeen years old. Showed that GIST was most effective in changing the subject choices and attitudes of middle class and/or academically able girls. The project seemed to have had much less effect on boys. Some of the effects of being in an action school did persist to age seventeen. There were a large number of significant differences between schools even after allowing for differences in intake.

General

1. Barbara Smail, Alison Kelly and Judith Whyte GIST Introductory Booklet Manchester Polytechnic, Nov 1979

Girls Into Science and Technology is an action research project aimed at encouraging girls to study scientific and technical subjects when they become optional at school. This introductory booklet for teachers outlines our plans for the project and the theory underlying the proposed interventions.

3. Barbara Smail, Judith Whyte and Alison Kelly 'Girls Into Science and Technology: the First Two Years' School Science Review Vol 63, pp 620-630, 1982. Reprinted in EOC Research Bulletin No 6, 1982; South Australian Science Teachers Association Journal No 813, pp 3-10, Dec 1981; Brown J. *et al* (eds) Science in Schools Open University Press, 1986.

This paper describes the implementation of the GIST project and the three main strategies used in the first two years. These were working with teachers to increase their awareness of girls' underachievement in science as a pedagogical problem: tests of the children's attitudes and achievements, the results of which were fed back to the schools to increase their self-awareness; and a programme of visits to schools (VISTA) by women working in scientific and technological jobs.

4. Barbara Smail, Judith Whyte and Alison Kelly 'Getting the GIST' Women and Education Newsletter No 23, pp 4-7, 1982

Shorter version of (3).

8. Barbara Smail and Judith Whyte 'Girls' Access to Engineering: What can be done in Schools?' EOC Research Bulletin Summer 1983

This paper describes the continuing work of the project in its second and third years. Teachers' attitudes are a crucial factor in the success or failure of educational innovation. The paper emphasises the strategies used by GIST to increase teachers' awareness of the processes at work in classrooms which gradually ease girls out of the scientific and technical subjects necessary for a career in engineering.

12. Judith Whyte 'GIST Matters' Schools Council News Summer 1983

Brief account of the activities of the GIST project from 1979 to 1983

22. Barbara Smail 'Yes to Science' Paper presented to Canadian Women in Science and Technology Conference, Vancouver, May 1983

Summarizes the rationale behind the GIST project and the main actions taken as the project progressed.

37. Barbara Smail 'An attempt to move mountains: the Girls Into Science and Technology (GIST) project' Journal of Curriculum Studies Vol 17, 351-354, 1985

Summary article describing the GIST project

46. Judith Whyte 'Girl-friendly science and the girl-friendly school' In Whyte J., Deem R., Kant L. & Cruickshank M. (eds) Girl-Friendly Schooling Methuen, 1985

Describes main outcomes of the GIST project, with emphasis on features of science teaching and school characteristics most likely to encourage girls to take physical science and crafts

49. Judith Whyte 'Le projet GIST' In Valabregue C. (ed) Fille ou Garcon: Education sans Prejuges Magnard, Paris, 1985

Report of main outcomes of the GIST project, prepared for an audience of French feminists and educationalists.

See also (30),(45)

Attitude and Achievement Surveys

2. Alison Kelly, Barbara Smail and Judith Whyte Initial GIST Survey: Results and Implications Manchester Polytechnic, Sept 1981

The GIST survey of 11 year olds covered attitudes and achievements in science and attitudes to sex roles. There was also some background information on home and school. This booklet outlines the main findings of the survey and suggests some practical implications for teachers which emerge from the findings.

6. Alison Kelly et al 'Gender Roles at Home and School' British Journal of Sociology of Education Vol 3. pp 281-295, 1982. Reprinted in Burton L (ed) Girls Into Maths Can Go Holt, Rinehart & Winston, 1986

The parents of first year pupils at one of the schools involved in the GIST project were studied by interview and questionnaire. They were asked about their aspirations for their children, their ideas about sexual equality and the way sex roles were manifested at home. Most of the parents had high aspirations for their children and were in favour of equality between the sexes. But their own sex roles and their underlying assumptions about women and men were very traditional.

14. Alison Kelly and Barbara Smail 'Sex stereotyping and attitudes to science among eleven year old schoolchildren' British Journal of Educational Psychology Vol 56, pp 158-168, 1986

A range of attitude, achievement and sex stereotyping tests were administered to 11 year old children in their first term at comprehensive school. The boys were found to be markedly more sex-stereotyped than the girls. Able girls and those from middle-class homes were slightly less sex-stereotyped than others. For both sexes a feminine self-image was weakly linked to low academic achievement, and a masculine self-image to high achievement. Children who endorsed sex stereotypes showed less interest than other children in learning about the areas of science traditionally associated with the opposite sex.

19. Barbara Smail and Alison Kelly 'Sex differences in science and technology among 11 year old school children: I Cognitive' Research in Science and Technological Education Vol 2, pp 61-76, 1984

2065 eleven year olds in their first term at secondary school were given three cognitive tests. Girls and boys were found to be approximately equal in science knowledge. Boys did slightly better on tests of physical science, especially when these were in multiple choice form, but otherwise there were few sex differences. Neither the style of the question (multiple choice or structured) nor the content (feminine or masculine) had any great effect on sex differences in performance. However boys performed markedly better than girls on tests of spatial ability and mechanical reasoning. These skills may be important for later success in technical studies at school.

20. Barbara Smail and Alison Kelly 'Sex differences in science and technology among 11 year old school children: II Affective' Research in Science and Technological Education Vol 2, pp 87-106, 1984

2065 eleven year olds in their first term at secondary school were given a variety of attitude and achievement tests. Overall both girls and boys had positive attitudes to science but there were substantial sex differences - boys were much keener than girls to learn about physical science and girls were keener than boys to learn about nature study and human biology. Boys had much greater experience than girls of tinkering activities, but girls had more experience of biological science activities. Boys were much more likely than girls to see science as a masculine preserve. At this age attitudes to science were virtually unrelated to achievement in science and technology related areas. One important exception to this is that girls who saw science as masculine tended to perform worse on the cognitive tests.

21. Alison Kelly 'The development of children's attitudes to science: a longitudinal study' in Lehrke M., Hoffman L. & Gardner P.L.(eds) Interests in Science and Technology Education Institute for Science Education (IPN), Kiel, Germany 1985 and European Journal of Science Education Vol 8, pp 319-412, 1986. Reprinted in International Council of Associations for Science Education (ICASE) Yearbook 1988 1988

1300 pupils at ten schools completed attitude to science tests when they were eleven and again two and a half years later. During that time their interest in most branches of science decreased, but both girls and boys became more interested in learning about human biology. Their opinions about science and scientists also became generally less favourable, but pupils grew more willing to see science as suitable for girls. The attitude changes varied considerably from school to school, and were slightly better in schools which had implemented a programme of interventions to improve children's attitudes than in other schools. There was considerable stability in the attitudes of individual children over the period of study

53. Alison Kelly 'Some notes on gender differences in mathematics' British Journal of Sociology of Education Vol 8, pp 305-311, 1987

In 1980 Sharma and Meighan suggested that pupils who studied physics and technical drawing performed better in mathematics O level than pupils who studied only arts subjects with mathematics. However their results were based on small samples and did not employ any control for general ability. This paper explores the same issues. It shows that studying physics did improve mathematics achievement, allowing for general ability, but studying technical drawing had no effect on grades

in mathematics. No overall sex difference in mathematics achievement at 16 was found.

54. Alison Kelly 'It ain't what you do, its the way that you do it: achievement, self-confidence and subject choice in science' In Dahms M. *et al* (eds) Women Challenge Technology, University of Aalborg, Denmark, 1986

Girls who continue with physics beyond third year are performing better in the subject, on average, than boys who continue. However many girls who are doing well at physics choose to drop the subject. This is partly due to girls having less confidence than boys in their own ability in physics. In fact the girls are quite accurate in their self-assessments, but the boys are over-confident. Physics and chemistry are generally only taken by more able pupils, but this is not true for biology. Physics and biology are sex stereotyped, but chemistry is not.

55. Alison Kelly 'The customer is always right... Girls' and boys' reactions to science lessons School Science Review Vol 69, pp 662-676, 1988

Third year pupils generally like science lessons, especially the experiments. They also enjoy most of the topics they study in science, although girls are more enthusiastic about biology and less keen on physical science. Boys have more confidence than girls in their own ability in physical science, although in fact the differences in achievement are small. Liking for the subject is the most consistent predictor of enrolment in fourth year, but self-confidence is also important for physics and chemistry.

56. Alison Kelly 'Does that train set matter? Scientific hobbies and science achievement and choice' In Daniels J.Z. & Kahle J.B. (eds) Contributions to the Fourth GASAT conference University of Michigan, USA, 1987.

At first sight it looks as though girls who have more experience of scientific hobbies and activities are more likely to chose to continue with scientific subjects when these become optional at school. But when home background is controlled there is little connection between pupils' early experience and their subject choice or achievement.

57. Alison Kelly 'Option choice for girls and boys' Research in Science and Technological Education Vol 61, pp 5-23, 1988.

Usefulness for getting a job, and interest and achievement in the subject were the most common reasons children gave for option choice. Boys perceived more support than girls from parents, teachers and friends for continuing with physics and technical craft when these subjects become optional at school. This support was one of the strongest predictors of subject choice. Sex had no direct influence on subject choice in physics, but operated indirectly through other variables such as enjoyment of the subject, person orientation and perceived usefulness for getting a job.

58. Alison Kelly 'Sex stereotypes and school science: a three year follow-up' Educational Studies Vol 14, pp 151-163, 1988.

Girls who saw themselves as masculine were slightly more likely than other girls to chose physical science when it became optional at school, while girls who saw themselves as feminine were slightly more likely to chose biology. Boys' self-images were not linked to option choices. However boys with a masculine self-image achieved slightly worse in science than other boys of similar general ability, whereas girls with a masculine self-image achieved slightly better than other girls.

59. Alison Kelly 'Ethnic differences in science choice, attitudes and achievement in Britain' British Educational Research Journal (in press).

Black and Asian pupils scored lower than comparable White children on science tests on entry to secondary school. However by fifth year Asian boys were out-performing White boys, while Black pupils achieved as well as White children from similar backgrounds and schools. White girls were less interested in physical science than other girls, and White boys were less interested in biology. Asian boys expressed greater liking for science and greater interest in learning about physical science than other boys.

60. Alison Kelly 'Who gets science education? An analysis by class, ability and gender'. In McNeil M., Varcoe I & Yearley S. (eds) Deciphering Science and Technology Macmillan Press (in press).

'Science for All' has become a slogan among science educators, and it is frequently argued that all pupils should spend 20% of their time in the last two years of compulsory schooling studying a broad and balanced science curriculum. But at present high ability, middle class pupils often study much more science than this, while a balanced science curriculum is most often provided for the least able pupils. Elite groups will probably oppose the spread of 'science for all'.

62. Alison Kelly 'When I grow up I want to be .... A longitudinal study of the development of job preferences among girls and boys' British Journal of Guidance and Counselling (in press)

There were enormous differences between the sexes in their job plans, although girls and boys gave similar responses to questions about the characteristics of their ideal job. There were also significant differences between children of different social class and academic ability, and some indications of differences between ethnic groups. Individual children showed little consistency in the occupations they named at age eleven, fourteen and seventeen, although some jobs, notably hairdressing and teaching did seem to be chosen at an earlier age than others. One of the strongest predictors or the occupational aspirations of seventeen year olds was their perception of what their parents wanted for them when they were fourteen. Boys' aspirations seemed to be based on their individual abilities and achievements, whereas girls' aspirations were more strongly related to ascribed factors such as social class.

See also (3),(15),(30),(45),(61)

Action Research

5. Judith Whyte and Barbara Small 'GIST as Action Research' EOC Research Bulletin Spring 1982

GIST was not simply a traditional research programme but combined active intervention, working through teachers in the schools, with investigation of pupils' attitudes and performance. This paper considers the value of action research, the nature and dynamics of the teacher-researcher relationship, and the methodological issue of how action research can be evaluated

23. Alison Kelly 'Action Research: What is it and what can it do?' in Burgess R. (ed) Issues in Educational Research: Qualitative Methods Falmer Press, 1985

Three different models of action research in school are identified -

'experimental social administration', 'teacher-researcher' and 'simultaneous-integrated'. The Girls Into Science and Technology project is an example of simultaneous-integrated action research, a type which has not previously been widely used in educational research. The advantages and disadvantages of this type of research are explored, and it is suggested that it is particularly suitable for projects which are explicitly value laden.

25. Judith Whyte 'Action Research in Practice: A Report from the GIST project'. Paper presented to conference on Action Research, Didsbury School of Education, Manchester Polytechnic, April 1983

This paper discusses the model and practice of 'action research' developed by the GIST project. It explores the reasons for rejecting either a 'pure' research or an 'unreflective action' approach in favour of a combined and interdependent action research model which can incorporate the twin aims of investigating the causes of female underachievement in science and technology while simultaneously trying to change the situation. The paper makes special reference to two action research activities by teachers in the GIST schools which reflect our definition of action research.

50. Judith Whyte 'Issues and dilemmas in action research'. In Walford G. (ed) Doing Sociology of Education Falmer Press, 1987

Reflects on the GIST project as a piece of action research, and the way it has thrown up some familiar issues such as the formation of a relationship with practitioners, the impact of research on practice and policy, together with newer dilemmas including the nature of feminist research in an educational context

51. Alison Kelly 'Education or Indoctrination: The Ethics of School-Based Action Research'. In Burgess R.G. (ed) The Ethics of Educational Research Falmer Press (in press)

Action research projects which originate outside the school raise ethical problems which are slightly different to those of other types of research. Chief amongst these is the issue of values, and what right the researcher has to introduce or promote a particular set of values within the school. It is argued that researchers generally have little power in schools, but have a right to attempt to introduce changes by negotiation. Perhaps more serious are the problems raised by the notion of informed consent, and the way in which teachers may lose sight of the research aspect of an action-research project. These issues are discussed with reference to the Girls Into Science and Technology (GIST) project.

Intervention Strategies

7. Judith Whyte, Alison Kelly, Barbara Smail and John Catton GIST: Options and Careers Manchester Polytechnic, August 1982

Most schools have an option system at the end of third year, when pupils have to choose what subjects to study in fourth and fifth year. The choices pupils make are often influenced by sex stereotypes, yet an inappropriate choice can severely limit career opportunities. This booklet contains information and advice for teachers on how to reduce sex stereotyping in option choice and later careers.

11. Barbara Smail 'Changing the Image of Women Scientists' Women and Training News No 9, p. 11, Winter 1982

This paper describes the scheme to enable children to meet women scientists under way in the eight GIST schools in Greater Manchester. The programme of visits by scientists, engineers, technicians and craftswomen (VISTA) is aimed at the 11-13 age group before children opt for the subjects they will study for examinations.

13. Judith Whyte 'Courses for Teachers on Sex Differences and Sex Typing' Journal of Education for Teaching Vol 9, pp 235-248, 1983.

Discusses an approach to study and discussion of gender issues on courses for practising and intending teachers. Advocates a distinction between 'personal' and 'professional' attitudes and describes the response to this approach of teachers on in-service and pre-service courses and of teachers participating in the GIST project

26. Barbara Smail (illustrations by Kim Barrington) Women in Science Manchester Polytechnic, October 1983

Workbook on women scientists, including some of the women on the EOC posters of Women Scientists (available from the EOC). Contains information about the women's lives and scientific work, with crosswords, quizzes and puzzles. Suitable for use with pupils in lower secondary school.

27. John Catton and Barbara Smail 'Removing the Blinkers' Women and Education Newsletter No 25, Summer 1983

Describes activities for pre-option choice work on the possibility of non-traditional career choices for girls and boys. The children's reactions are also described. Particularly interesting was the negative response of many of the boys to males in traditionally female jobs. In boys' eyes the sexuality of these men was suspect because of their job choice.

39. John Thompson 'Some Unseen Effects of GIST' in Hustler D., Cassidy T. & Cuff T. (eds) Action Research in Classrooms and Schools Allen & Unwin, 1986

Article by the Head of Science at one of the GIST schools, which illustrates the unexpected spin-offs into the whole school from the GIST project. These were particularly marked in the curriculum area. Describes some of the interventions used in this school, and suggests that many of the effects of the project were unmeasured and unmeasurable. Teachers may have gained more than pupils from their involvement.

40. David Bowes 'Single Sex Science Teaching: a Route to Bias-Free Choices in Science for Third Year Pupils' in Hustler D., Cassidy T. & Cuff T. (eds) Action Research in Classrooms and Schools Allen & Unwin, 1986

Account of an experiment in single-sex setting at one of the schools involved in the GIST project. In the first year this was tried the children made much less sex-stereotyped option choices than in previous years. In subsequent years the effect was not so great. The girls generally had positive attitudes about being on their own, but the boys did not like being segregated.

41. Sydney Slater 'Curriculum Innovation and Evaluation' in Hustler D., Cassidy T. & Cuff T. (eds) Action Research in Classrooms and Schools Allen & Unwin, 1986

General comments on the conduct and evaluation of the experiment on single-sex setting at one school (see 40)

47. Judith Whyte Gender, Science and Technology: In-Service Handbook SCDC/Longmans, 1985. £3.25, pp68

Drawing on the GIST experience of teacher workshops, curriculum development and classroom observation, the handbook offers materials in the form of lecturettes, games, quizzes and exercises suitable for use on in-service courses based in schools or colleges. Aimed at tutors or Departmental heads concerned with science and technology education for teachers

See also (3),(17),(28),(30),(31),(38),(45)

Classroom Observation

9. Judith Whyte 'The Dominant Male' Times Educational Supplement 31/12/82

Boys demand more than their fair share of both resources and the teachers' attention in laboratories and workshops but teachers can find ways to balance the patterns of interaction.

18. Judith Whyte 'Observing Sex Stereotypes and Interaction in the School Lab and Workshop' Educational Review Vol 3, pp 75-86, 1984

Classroom observation was used to increase teachers' awareness of the relative participation of girls and boys in science and craft lessons. With observer feedback teachers managed to shift the balance of teacher-pupil interactions towards greater equality. However some teachers felt that their efforts might have disadvantaged the boys in the class. Observations also revealed that boys' confident assurance in their rightful possession of both teachers' attention and the available resources pre-empted girls' ability to establish a firm foothold in these 'masculine' subject areas. Classroom patterns of sex differentiation are not unchangeable, but systematic evaluations over a period of time are needled to help teachers become aware of imbalances in their classes.

33. Alison Kelly 'The Construction of Masculine Science' British Journal of Sociology of Education vol 6, pp133-154, 1985. Part reprinted in Arnot M. & Weiner G. (eds) Gender and the Politics of Schooling Hutchinson, 1986 and in Kelly A. (ed) Science for Girls Open University Press, 1987

This article discusses the way in which the conceptions of masculinity and femininity which pupils bring with them to the science laboratory influence their behaviour. This in turn leads to science being seen as a masculine subject, and the characteristic of girls who participate in it as unfeminine. The theoretical analysis is based upon classroom incidents observed during the GIST project.

42. Glynis Ward 'Observing with GIST' in Hustler D., Cassidy T. & Cuff T. (eds) Action Research in Classrooms and Schools Allen & Unwin, 1986

A teacher's account of the experience both of being observed and of observing her colleagues', using the GIST observation schedule to concentrate on teacher interactions with girls and boys.

Engineering and Technology

10. John Catton 'Girls in CDT - Some Teacher Strategies for Mixed Groups' Studies in Design Education, Craft and Technology Vol 15, Number 1, Winter 1982

Very few girls continue to study CDT beyond the third year in secondary

school. A number of factors appear to contribute to this imbalance, but subject teachers are particularly influential. By confronting the problem and adopting a positive approach towards the girls they can do much to help. The article describes some of the author's recent experience, giving examples of how girls were encouraged to take an active part in the CDT lessons.

15. Barbara Smail 'Spatial Visualization Skills and Technical Craft Education' Educational Research Vol 25, pp 230-231, 1983

During the initial programme of testing on the GIST project a natural experiment occurred in one school which suggested that spatial visualization skills might be enhanced by introductory lessons in technical drawing and three dimensional work in wood and metal. Girls and boys who received a 12 week course of technical craft lessons on entry to secondary school increased their scores on a spatial visualization test more than those taking a parallel course of domestic subjects. The difference was significant at the 5% level. This finding, coupled with other evidence from the GIST Initial Survey, supports the theory that sex and subject specialism differences in spatial ability result largely from environmental rather than innate factors and can be modified by experience.

28. Peter Toft and John Catton 'More than Half-Way There' Times Educational Supplement 7/10/83

This article describes a school visit which was made as part of the GIST project. Third year girls were taken round the design workshop at Manchester Polytechnic to give them an opportunity to meet women students in this field and to increase their awareness of the opportunities.

52. Judith Whyte 'Starting early: girls and engineering' European Journal of Engineering Education (in press)

Account of the GIST project and its outcomes, with special reference to the implications for policy makers and practitioners concerned with engineering education.

See also (8),(38)

Teachers' Reactions

16. John Thompson 'GIST Girls Into Science and Technology' Teaching London Kids No 19, 1982

An account by one of the science teachers at a GIST school of his perceptions of the project's work.

17. Judith Whyte and Barbara Smail 'Initial Teachers' Workshops in the GIST Project: A Tentative, Interim Assessment'. Paper presented to British Educational Research Association Conference, Cardiff, September 1980

Discusses the conduct of the workshops which were run to alert teachers to the problems of sex stereotyping in schools, and their own role in the perpetuation of these stereotypes. Different sorts of teacher reaction are discussed

24. George Payne, David Hustler and Ted Cuff GIST or PIST: Teachers' Perceptions of the Project Girls Into Science and Technology Manchester Polytechnic, 1984

An independent team of three male sociologists talked to a sample of the teachers who worked with GIST about their reactions to and perceptions of the project. Most teachers seemed to think that GIST was laudable in its aims, but that their own practice had changed little because of their involvement in the project.

34. Alison Kelly et al 'Traditionalists and Trendies: Teachers' Attitudes to Educational Issues' British Educational Research Journal Vol 11, 91-104, 1985. Reprinted in Weiner G. & Arnot M. (eds) Gender under Scrutiny Hutchinson, 1987

Questionnaires were sent to 900 secondary school teachers throughout England and Wales; 373 (41%) were returned. Teachers agreed on many issues but opinion was divided on the abolition of the remaining grammar schools and the question of mixed-ability teaching. Underlying dimensions of traditionalism, belief in equality of the sexes and feminism were identified in teachers' attitudes. Older teachers were more traditional than younger ones, and science and craft teachers were more traditional than arts teachers. Women were more emphatic about sex equality than men and London teachers were more feminist than others. Teachers in schools which had been involved in the GIST project were slightly less traditional and more in favour of equality of the sexes than other teachers

35. Alison Kelly 'Changing Schools and Changing Society: some reflections on the Girls Into Science and Technology project' in Arnot M. (ed) Race and Gender: Equal Opportunities Policies in Education Open University Press, 1986

The GIST project contained many of the features which have previously been found to be characteristic of successful innovations; yet it was less successful than had been hoped. This may have been because it contained an implicit critique, not only of teachers' professional practice, but also of their personal lives. Projects of this kind tend to be either rejected as unacceptably radical, or absorbed with little or no change in established practices. However the GIST project did have the effect of making the position of girls in science a respectable educational issue, and it may be that this in itself is a major force for change.

36. Alison Kelly 'Working with Teachers' Forum Vol 28, pp 10-12, 1985

A shortened and simplified version of (35)

43. David Hustler and Ted Cuff 'Teachers' Perceptions of the GIST project: an Independent Evaluation' in Hustler D., Cassidy T. & Cuff T. (eds) Action Research in Classrooms and Schools Allen & Unwin, 1986

Comments on the problems associated with the evaluation reported in (24) and summarises its main results. Argues that there are clear, if variable, signs of GIST having made some impact in all four schools they visited.

See also (13),(39),(45),(47)

Curriculum Analysis

21. Barbara Small 'Getting Science Right for Girls' Proceedings of Second GASAT conference, Oslo, September 1983

This paper builds a rationale for modifying lower school science curricula to better match the concerns of girls. The theoretical model is based on recent ideas derived from feminist critiques of the masculine perspective of developmental psychology. The traditional approach to science education also reflects this male stance. Examples of practice from the GIST project suggest how school science must change to engage the interest and meet the needs of all pupils, not merely the future scientific elite.

See also (31),(39)

Comparative

32. Judith Whyte 'Sex related differences in subject choice and intervention strategies used to reduce girls' educational disadvantages: a comparative review'. In Lenrke M., Hoffman L. & Gardner P.L.(eds) Interests in Science and Technology Education Institute for Science Education (IPN), Kiel, Germany 1985

Compares shortfall of British girls in science with situation in several other European countries, including France and Norway, concluding that postponement of subject choice is a necessary, but not a sufficient, condition for more girls to take subject options traditionally considered as masculine

44. Judith Whyte Encouraging Girls into Science and Technology: Some European Initiatives UNESCO Science and Technology Education Document Series No 7, UNESCO, Paris 27pp.

Analyses the initiatives being taken in several Western European countries under various headings, including curriculum options, science, crafts/technology, work experience, teachers and classrooms and careers for women and girls in science and technology. Forms part of a UNESCO project on 'Access of women to science education, training and associated careers' consisting of research and recommendations. France, Czechoslovakia, Malaysia, Venezuela and Senegal also took part in the project

48. Judith Whyte 'Reducing the waste of womanpower' Quarterly Journal of Social Affairs Vol 1 (3) pp 193-210, 1985

Paper based on end-of-grant report to the Social Affairs Committee of the ESRC. Compares the efficacy of intervention aimed at schoolgirls, describing the GIST project, with strategies aimed alternatively at the school leaver and the older woman. Concludes there is a need for determined effort at all stages, but little evidence of positive commitment to change on the part of policy makers.

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